FCC CO-LOCATION RADIO TEST REPORT

FCC ID	:	**2BHFNHESTIAA2**
Equipment	:	**NTN-LoRaWAN Dongle**
Brand Name	:	**APAL**
Model Name	:	**Hestia A2**
Applicant	:	**Creative5 Inc.** **7F, No. 300, Sec. 1, Neihu Rd., Neihu Dist.** **Taipei City, 11493, Taiwan**
Manufacturer	:	**Creative5 Inc.** **7F, No. 300, Sec. 1, Neihu Rd., Neihu Dist.** **Taipei City, 11493, Taiwan**
Standard	:	**FCC Part 15 Subpart C §15.247** **FCC 47 CFR Part 2, and 25**

The product was received on Jan. 09, 2025 and testing was performed from Apr. 08, 2025 to Apr. 18, 2025. We, Sporton International Inc. Wensan Laboratory, would like to declare that the tested sample has been evaluated in accordance with the test procedures and has been in compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval from Sporton International Inc. Wensan Laboratory, the test report shall not be reproduced except in full.

Louis Wu

Approved by: Louis Wu

Sporton International Inc. Wensan Laboratory
No.58, Aly. 75, Ln. 564, Wenhua 3rd, Rd., Guishan Dist., Taoyuan City 333010, Taiwan (R.O.C.)

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History of this test report

Report No.	Version	Description	Issue Date
FR480227-01B	01	Initial issue of report	May 07, 2025

Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
3.1	15.247(d)	Radiated Band Edges and Radiated Spurious Emission	Pass	-
3.2	15.203 15.247(b)	Antenna Requirement	Pass	-

Note: For host device, Radiated Spurious Emission is verified and complies with the limit in this test report.

Conformity Assessment Condition:
1. The test results (PASS/FAIL) with all measurement uncertainty excluded are presented against the regulation limits or in accordance with the requirements stipulated by the applicant/manufacturer who shall bear all the risks of non-compliance that may potentially occur if measurement uncertainty is taken into account. 2. The measurement uncertainty please refer to each test result in the section “Measurement Uncertainty”.
Disclaimer:
The product specifications of the EUT presented in the test report that may affect the test assessments are declared by the manufacturer who shall take full responsibility for the authenticity.

Reviewed by: Keven Cheng

Report Producer: Ming Chen

1 General Description

1.1 Product Feature of Equipment Under Test

Product Feature
General Specs NTN, LoRa, and GNSS. **Antenna Type** LoRa: Dipole Antenna NTN: Monopole Antenna

Remark: The EUT's information above is declared by manufacturer. Please refer to Disclaimer in report summary.

1.2 Modification of EUT

No modifications made to the EUT during the testing.

1.3 Testing Location

Test Site	Sporton International Inc. Wensan Laboratory
Test Site Location	No.58, Aly. 75, Ln. 564, Wenhua 3rd, Rd., Guishan Dist., Taoyuan City 333010, Taiwan (R.O.C.) TEL: +886-3-327-0868 FAX: +886-3-327-0855
Test Site No.	**Sporton Site No.**
	03CH16-HY

Note: The test site complies with ANSI C63.4 2014 requirement.

FCC designation No.: TW3786

1.4 Applicable Standards

According to the specifications declared by the manufacturer, the EUT must comply with the requirements of the following standards:

- FCC Part 15 Subpart C §15.247
- FCC KDB Publication No. 558074 D01 15.247 Meas Guidance v05r02
- FCC KDB 414788 D01 Radiated Test Site v01r01.
- ANSI C63.10-2013
- FCC 47 CFR Part 2, 25

Remark:

1. All the test items were validated and recorded in accordance with the standards without any modification during the testing.
2. The TAF code is not including all the FCC KDB listed without accreditation.
3. This EUT has also been tested and complied with the requirements of FCC Part 15, Subpart B, recorded in a separate test report.

2 Test Configuration of Equipment Under Test

a. The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: radiation emission (9 kHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower). For radiated measurement, the measured emission level of the EUT was maximized by rotating the EUT on a turntable, adjusting the orientation of the EUT and EUT antenna in three orthogonal axis (X: flat, Y: portrait, Z: landscape), and adjusting the measurement antenna orientation, following C63.10 exploratory test procedures and only the worst case emissions were reported in this report.

2.1 Carrier Frequency and Channel

Channel Bandwidth: 500KHz	
Channel	**Freq. (MHz)**
71	914.2

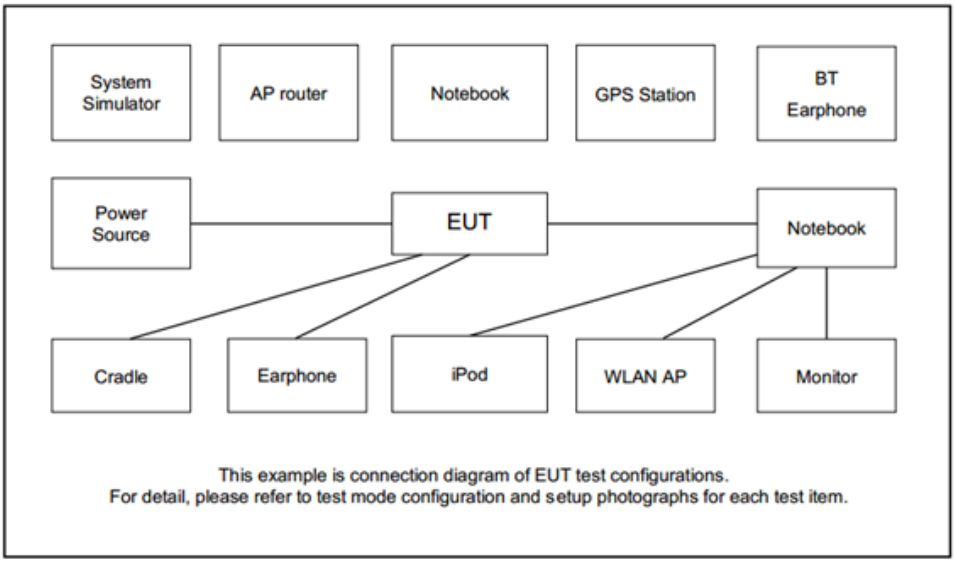
Band 255 Channel and Frequency List	
Channel/Frequency(MHz)	**Middle**
Channel	261674
Frequency	1643.5

2.2 Test Mode

<Co-Location>

Test Mode	Modulation	Data Rate
Mode 1	**Lora BW 500KHz SF 8 TX + NTN Band 255 M CH 3.75k 1SC0**	**500KHz + 1SC0**

2.3 Connection Diagram of Test System



2.4 Support Unit used in test configuration and system

Item	Equipment	Brand Name	Model Name	FCC ID	Data Cable	Power Cord
1.	System Simulator	Anritsu	MT8821C	N/A	N/A	Unshielded, 1.8 m
2.	Notebook	Lenovo	L570	FCC DoC	N/A	AC I/P: Unshielded, 1.2 m DC O/P: Shielded, 1.8 m

3 Test Result

3.1 Radiated Band Edges and Spurious Emission Measurement

3.1.1 Limit of Radiated band edge and Spurious Emission Measurement

In any 100 kHz bandwidth outside the intentional radiator frequency band, all harmonics/spurious must be at least 20 dB below the highest emission level within the authorized band. If the output power of this device is measured by spectrum analyzer, the attenuation under this paragraph shall be 30 dB instead of 20 dB. In addition, radiated emissions which fall in the restricted bands must also comply with the limits as below.

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30.0	30	30
30 – 88	100	3
88 – 216	150	3
216 - 960	200	3
Above 960	500	3

3.1.2 Measuring Instruments

Please refer to the measuring equipment list in this test report.

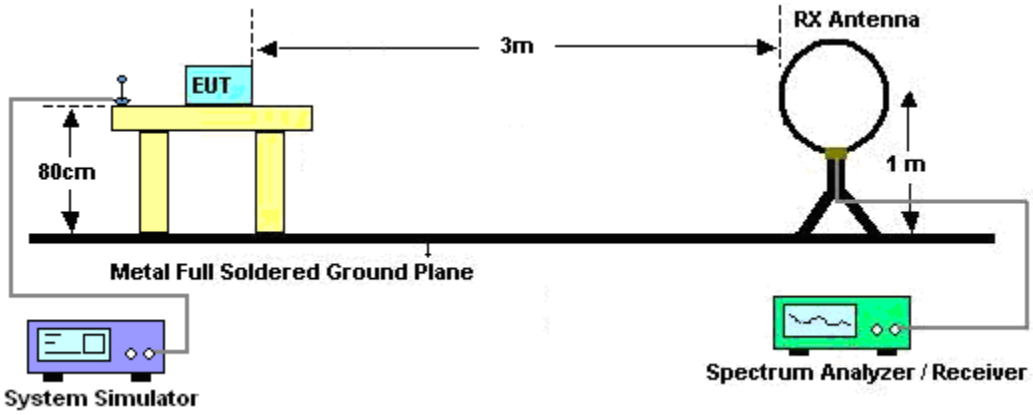
3.1.3 Test Procedures

1. The testing follows the ANSI C63.10 Section 11.12.1 Radiated emission measurements.
2. The EUT is arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level.
3. The EUT is placed on a turntable with 0.8 meter for frequency below 1 GHz and 1.5 meter for frequency above 1 GHz respectively above ground.
4. The EUT is set 3 meters away from the receiving antenna, which is mounted on the top of a variable height antenna tower.
5. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level
6. Radiated testing below 1 GHz is performed by adjusting the antenna tower from 1 m to 4 m and by rotating the turn table from 0 degree to 360 degrees to find the peak maximum hold reading. When there is no suspected emission found and the emission level is with at least 6 dB margin against QP limit line, the position is marked as "-".

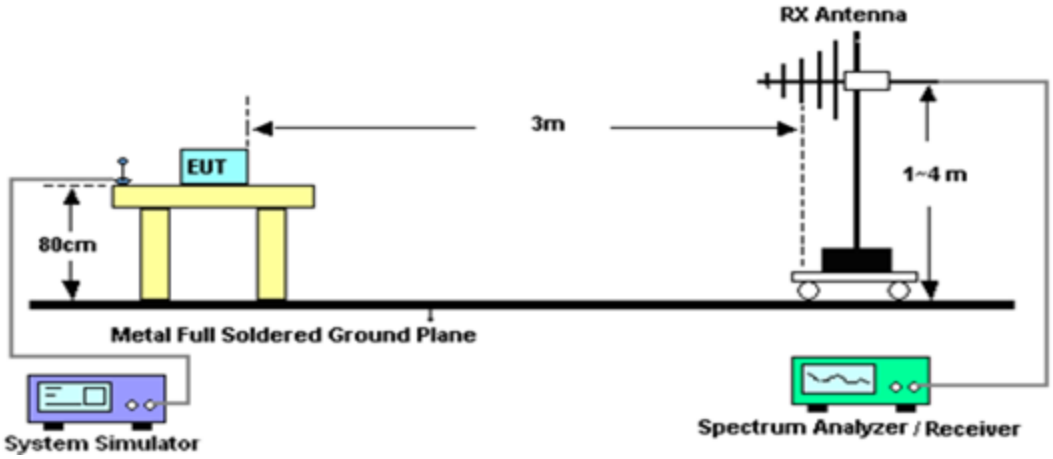
7. Radiated testing above 1 GHz is performed by adjusting the antenna tower from 1 m to 4 m and by rotating the turn table from 0 degree to 360 degrees to find the peak maximum hold reading for scanning all frequencies. When there is no suspected emission found and the harmonic emission level is with at least 6 dB margin against average limit line, the position is marked as "-".
8. Use the following spectrum analyzer settings:
   (1) Span shall wide enough to fully capture the emission being measured;
   (2) Set RBW = 100 kHz for f < 1 GHz; VBW ≥ RBW; Sweep = auto; Detector function = peak; Trace = max hold;
   (3) Set RBW = 1 MHz, VBW= 3 MHz for f ≥ 1 GHz for peak measurement.
   For average measurement:
   - VBW = 10 Hz, when duty cycle is no less than 98 percent.
   - VBW ≥ 1/T, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.

3.1.4 Test Setup

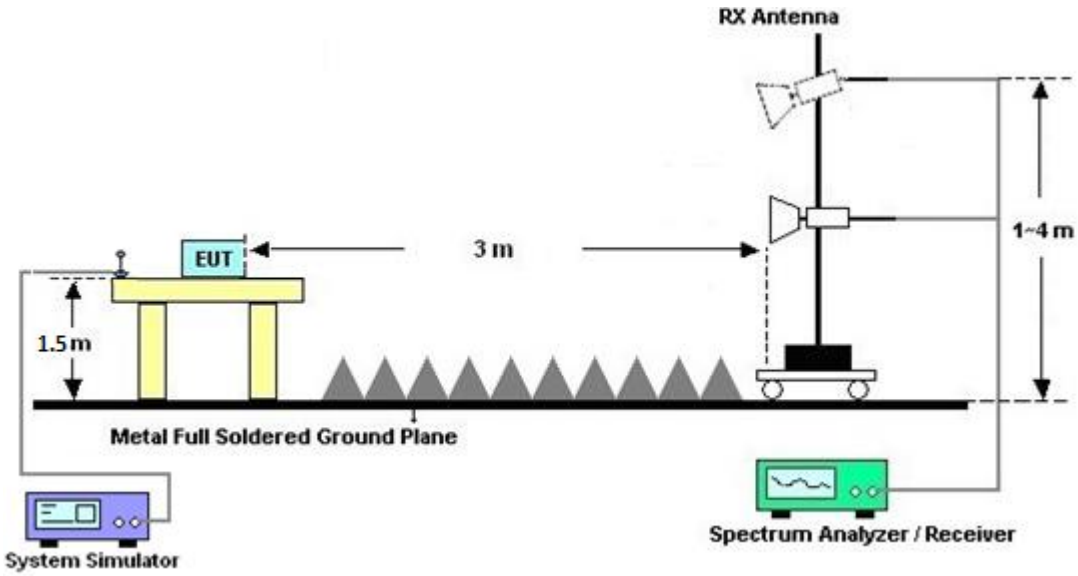
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated test above 1GHz



3.1.5 Test Results of Radiated Spurious Emissions (9kHz ~ 30MHz)

The low frequency, which starts from 9 kHz to 30 MHz, is pre-scanned and the result which is 20 dB lower than the limit line is not reported.

There is adequate comparison measurement of both open-field test site and alternative test site - semi-Anechoic chamber according to 414788 D01 Radiated Test Site v01r01, and the result comes out very similar.

3.1.6 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix A.

3.1.7 Duty Cycle

Please refer to Appendix B.

3.1.8 Test Result of Radiated Spurious Emission (30MHz ~ 10th Harmonic)

Please refer to Appendix A.

3.2 Antenna Requirements

3.2.1 Standard Applicable

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of § 15.211, 15.213, 15.217, 15.219, 15.221, or § 15.236. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with § 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

3.2.2 Antenna Anti-Replacement Construction

Unique (non-standard) antenna connector.

4 List of Measuring Equipment

Instrument	Brand Name	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Loop Antenna	Rohde & Schwarz	HFH2-Z2	100488	9kHz~30MHz	Aug. 29, 2024	Apr. 08, 2025~ Apr. 15, 2025	Aug. 28, 2025	Radiation (03CH16-HY)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA9170	1224	18GHz-40GHz	Oct. 25, 2024	Apr. 08, 2025~ Apr. 15, 2025	Oct. 24, 2025	Radiation (03CH16-HY)
EMI Test Receiver	Keysight	N9038A(MXE)	MY57290111	3Hz~26.5GHz	Nov. 22, 2024	Apr. 08, 2025~ Apr. 15, 2025	Nov. 21, 2025	Radiation (03CH16-HY)
Bilog Antenna	TESEQ	CBL 6111D & 00802N1D01N-06	47020 & 06	30MHz to 1GHz	Oct. 05, 2024	Apr. 08, 2025~ Apr. 15, 2025	Oct. 04, 2025	Radiation (03CH16-HY)
Horn Antenna	SCHWARZBECK	BBHA 9120 D	9120D-1328	1G~18GHz	Dec. 06, 2024	Apr. 08, 2025~ Apr. 15, 2025	Dec. 05, 2025	Radiation (03CH16-HY)
Amplifier	SONOMA	310N	371607	9kHz~1GHz	Jul. 02, 2024	Apr. 08, 2025~ Apr. 15, 2025	Jul. 01, 2025	Radiation (03CH16-HY)
Preamplifier	Keysight	83017A	MY53270264	1GHz~26.5GHz	Dec. 05, 2024	Apr. 08, 2025~ Apr. 15, 2025	Dec. 04, 2025	Radiation (03CH16-HY)
Preamplifier	EMEC	EM1G18G	060812	1GHz~18GHz	Dec. 24, 2024	Apr. 08, 2025~ Apr. 15, 2025	Dec. 23, 2025	Radiation (03CH16-HY)
Preamplifier	EMEC	EM18G40G	060801	18GHz~40GHz	May 27, 2024	Apr. 08, 2025~ Apr. 15, 2025	May 26, 2025	Radiation (03CH16-HY)
Filter	Wainwright	WLK4-1000-1530-8000-40SS	SN17	1.53GHz Low Pass Filter	Jan. 14, 2025	Apr. 08, 2025~ Apr. 15, 2025	Jan. 13, 2026	Radiation (03CH16-HY)
Filter	Wainwright	WHKX12-2700-3000-18000-60ST	SN3	3GHz High Pass Filter	Jun. 28, 2024	Apr. 08, 2025~ Apr. 15, 2025	Jun. 27, 2025	Radiation (03CH16-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	801606/2	9KHz ~ 40GHz	Apr. 22, 2024	Apr. 08, 2025~ Apr. 15, 2025	Apr. 21, 2025	Radiation (03CH16-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102/SUCOFLEX 104	EC-A5-300-5757,805935/4,802434/4	30MHz~18GHz	Aug. 07, 2024	Apr. 08, 2025~ Apr. 15, 2025	Aug. 06, 2025	Radiation (03CH16-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	804011/2, 804012/2	18-40GHz	Dec. 31, 2024	Apr. 08, 2025~ Apr. 15, 2025	Dec. 30, 2025	Radiation (03CH16-HY)
Software	Audix	E3 230621 V9	RK-002393	N/A	N/A	Apr. 08, 2025~ Apr. 15, 2025	N/A	Radiation (03CH16-HY)
Controller	ChainTek	3000-1	N/A	Control Turn table & Ant Mast	N/A	Apr. 08, 2025~ Apr. 15, 2025	N/A	Radiation (03CH16-HY)
Antenna Mast	ChainTek	MBS-520-1	N/A	1m~4m	N/A	Apr. 08, 2025~ Apr. 15, 2025	N/A	Radiation (03CH16-HY)
Turn Table	ChainTek	T-200-S-1	N/A	0~360 Degree	N/A	Apr. 08, 2025~ Apr. 15, 2025	N/A	Radiation (03CH16-HY)

5 Measurement Uncertainty

Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**6.5 dB**

Uncertainty of Radiated Emission Measurement (1000 MHz ~ 6000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**4.9 dB**

Uncertainty of Radiated Emission Measurement (6000 MHz ~ 18000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**5.1 dB**

Appendix A. Test Results of Radiated Test

A1. Radiated Spurious Emission Test Modes

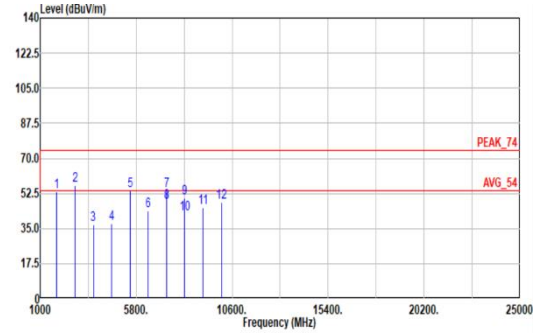
Mode	Band (MHz)	Antenna	Modulation	Channel	Frequency	Data Rate	RU	Remark
Mode 3	902-928	1	Lora BW 500KHz SF 8 TX + NTN Band 255 M CH 3.75k 1SC0	914.2MHz	914.2MHz	-	-	-

A2. Summary of each worse mode

Mode	Modulation	Ch.	Freq. (MHz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pol.	Peak Avg.	Result	RU	Remark
3	Lora BW 500KHz SF 8 TX + NTN Band 255 M CH 3.75k 1SC0	914.2MHz	187.14	36.97	43.5	-6.53	V	Peak.	Pass	-	LF
		914.2MHz	7313.60	48.90	54.00	-5.10	V	Avg.	Pass	-	Harmonic

Mode	3	
	Harmonic	
	Lora BW 500KHz SF 8 TX+ NTN Band 255 M CH 3.75k 1SC0	
ANT	1	
Pol.	Horizontal	Vertical

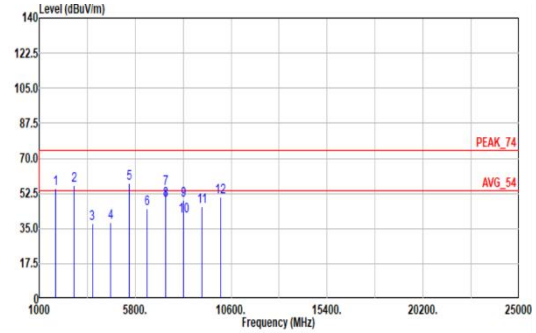
Peak



Site : 03CH16-HY
Condition: PEAK_74 3m 9120D-1328_241206 HORIZONTAL

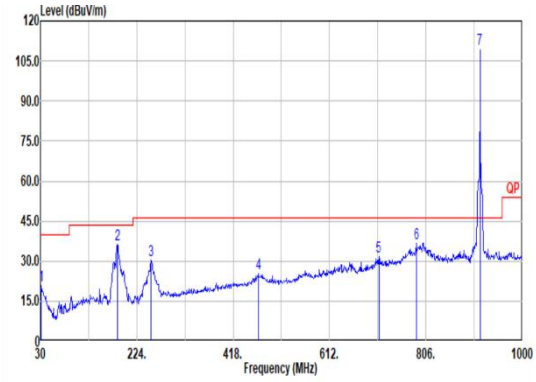
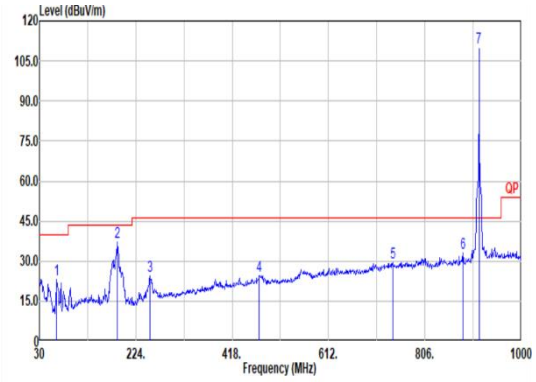
	Freq	Level	Limit Line	Margin	Read Level	Ant Factor	Cable Loss	Preamp Factor	Aux Factor	APos	TPos	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	dB	dB	dB	cm	deg	
1	1828.40	53.44	74.00	-20.56	41.43	25.58	6.73	30.63	0.41	--	--	PEAK
2	2742.00	56.72	74.00	-17.28	40.61	27.80	8.22	30.25	0.43	--	--	PEAK
3	3656.80	36.95	74.00	-37.05	64.12	29.28	9.46	66.85	0.94	--	--	PEAK
4	4571.00	37.59	74.00	-36.41	62.02	30.94	10.69	66.59	0.53	--	--	PEAK
5	5485.20	53.96	74.00	-20.04	75.87	31.98	11.52	65.80	0.39	295	345	PEAK
6	6399.40	44.10	74.00	-29.90	62.64	33.92	12.42	65.49	0.61	--	--	PEAK
7	7313.60	53.98	74.00	-20.02	69.45	36.56	13.29	65.76	0.44	202	306	PEAK
8	7313.60	48.00	54.00	-6.00	63.47	36.57	13.29	65.76	0.43	202	306	AVERAGE
9	8227.80	50.01	74.00	-23.99	64.65	36.62	14.07	65.79	0.46	205	20	PEAK
10	8227.80	42.02	54.00	-11.98	56.68	36.59	14.08	65.79	0.46	205	20	AVERAGE
11	9142.00	45.60	74.00	-28.40	58.03	38.04	14.75	65.85	0.63	--	--	PEAK
12	10056.20	48.18	74.00	-25.82	59.90	39.10	15.57	66.85	0.46	--	--	PEAK

Avg



Site : 03CH16-HY
Condition: PEAK_74 3m 9120D-1328_241206 VERTICAL

	Freq	Level	Limit Line	Margin	Read Level	Ant Factor	Cable Loss	Preamp Factor	Aux Factor	APos	TPos	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	dB	dB	dB	cm	deg	
1	1828.40	55.03	74.00	-18.97	43.07	25.54	6.72	30.64	0.42	--	--	PEAK
2	2742.60	56.27	74.00	-17.73	40.16	27.80	8.22	30.25	0.43	--	--	PEAK
3	3656.80	37.73	74.00	-36.27	64.90	29.28	9.46	66.85	0.94	--	--	PEAK
4	4571.00	37.84	74.00	-36.16	62.26	30.95	10.69	66.59	0.53	--	--	PEAK
5	5485.20	57.39	74.00	-16.61	79.30	31.98	11.52	65.80	0.39	294	360	PEAK
6	6399.40	44.75	74.00	-29.25	63.29	33.92	12.42	65.49	0.61	--	--	PEAK
7	7313.60	54.91	74.00	-19.09	70.38	36.57	13.29	65.76	0.43	308	311	PEAK
8	7313.60	48.90	54.00	-5.10	64.37	36.57	13.29	65.76	0.43	308	311	AVERAGE
9	8227.80	49.34	74.00	-24.66	64.00	36.59	14.08	65.79	0.46	177	335	PEAK
10	8227.80	41.44	54.00	-12.56	56.10	36.59	14.08	65.79	0.46	177	335	AVERAGE
11	9142.00	45.84	74.00	-28.16	58.27	38.04	14.75	65.85	0.63	--	--	PEAK
12	10056.20	50.98	74.00	-23.02	62.71	39.07	15.58	66.84	0.46	--	--	PEAK

Mode	3	
	LF	
	Lora BW 500KHz SF 8 TX+ NTN Band 255 M CH 3.75k 1SC0	
ANT	1	
Pol.	Horizontal	Vertical
QP/ Peak		

Site : 03CH16-HY
Condition: QP 3m CBL6111D&00802N1D01N-06 _47020 & 06_241005 HORIZONTAL

	Freq	Level	Limit Line	Margin	Read Level	Ant Factor	Cable Loss	Preamp Factor	Aux Factor	APos	TPos	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	dB	dB	dB	cm	deg	
1	30.97	20.90	40.00	-19.10	28.31	24.25	0.90	32.61	0.05	--	--	Peak
2	185.20	36.05	43.50	-7.45	51.01	15.14	2.12	32.30	0.08	--	--	Peak
3	252.13	30.16	46.00	-15.84	41.10	18.94	2.46	32.41	0.07	--	--	Peak
4	468.44	25.20	46.00	-20.80	31.00	23.35	3.37	32.66	0.14	--	--	Peak
5	710.94	31.59	46.00	-14.41	32.62	26.85	4.14	32.16	0.14	--	--	Peak
6	786.60	36.72	46.00	-9.28	36.21	28.13	4.35	32.17	0.20	--	--	Peak
7	914.64	109.79	------	------	107.42	29.59	4.71	32.12	0.19	100	11	Peak

Site : 03CH16-HY
Condition: QP 3m CBL6111D&00802N1D01N-06 _47020 & 06_241005 VERTICAL

	Freq	Level	Limit Line	Margin	Read Level	Ant Factor	Cable Loss	Preamp Factor	Aux Factor	APos	TPos	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	dB	dB	dB	cm	deg	
1	64.92	22.91	40.00	-17.09	41.74	12.17	1.25	32.30	0.05	--	--	Peak
2	187.14	36.97	43.50	-6.53	52.04	15.06	2.13	32.34	0.08	--	--	Peak
3	252.13	24.33	46.00	-21.67	35.27	18.94	2.46	32.41	0.07	--	--	Peak
4	472.32	24.58	46.00	-21.42	30.36	23.39	3.38	32.69	0.14	--	--	Peak
5	741.01	29.55	46.00	-16.45	28.96	28.31	4.23	32.09	0.14	--	--	Peak
6	882.63	32.96	46.00	-13.04	31.35	29.05	4.63	32.24	0.17	--	--	Peak
7	914.64	110.25	------	------	107.88	29.59	4.71	32.12	0.19	100	97	Peak

Appendix B. Duty Cycle Plots

Band	Duty Cycle(%)	T(us)	1/T(kHz)	VBW Setting
Lora BW 500KHz SF 8 TX	14.82	17700	0.06	100Hz

Lora BW 500KHz SF 8 TX