

Nemko Korea Co., Ltd.

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FCC EVALUATION REPORT FOR CERTIFICATION

Applicant :

i-SENS, Inc.
43, Banpo-daero 28-gil, Seocho-gu,
Seoul 06646, KOREA, REPUBLIC OF
Attn. : So Young Kang

Dates of Issue : January 20, 2021
Test Report No. : NK-20-R-358
Test Site : Nemko Korea Co., Ltd.

FCC ID**OELPN300107****Brand Name**

N/A

Contact Person

i-SENS, Inc.
43, Banpo-daero 28-gil, Seocho-gu, Seoul 06646,
KOREA, REPUBLIC OF
So Young Kang
Telephone No. : +82-2-910-0630

Applied Standard: FCC 47 CFR Part 15.225**Classification:** Part 15 Low Power Communication Device Transmitter (DXX)**EUT Type:** PT/INR Monitoring Meter

The device bearing the brand name and model specified above has been shown to comply with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in ANSI C63.10-2013. The client should not use it to claim product endorsement by TAF or any government agencies. The test results in the report only apply to the tested sample.

I attest to the accuracy of data and all measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.


Jan. 20, 2021

Tested By : Chanho Jin
Engineer


Jan. 20, 2021

Reviewed By : Seungyong Shin
Technical Manager

Revision History

Rev.	Issue Date	Revisions	Revised By
00	January 20, 2021	Initial issue	

TABLE OF CONTENTS

1. Scope	5
2. Introduction (Site Description)	6
2.1 Test facility	6
2.2 Accreditation and listing	7
3. Test Conditions & EUT Information	8
3.1 Operation During Test	8
3.1.1 Table of test power setting	8
3.1.2 Table of test channels	8
3.1.3 Antenna Information	8
3.1.4 Additional Information Related to Testing	8
3.1.5 Table of test modes	9
3.2 Support Equipment	10
3.3 Setup Drawing	10
3.4 EUT Information	11
4. Summary of Test Results	12
5. Recommendation / Conclusion	13
6. Antenna Requirements	14
7. Description of Test	15
7.1 Radiated Emissions	15
7.2 20 dB Bandwidth	16
7.3 Frequency Tolerance	16
8. Test Data	17
8.1 Radiated Emissions	17
8.2 The field strength of any emission within the band 13.110~14.010 MHz	20
8.3 20 dB Bandwidth	22
8.4 Frequency Tolerance	24



9. Test Equipment	25
10. Accuracy of Measurement	26

1. SCOPE

Measurement and determination of electromagnetic emissions (EME) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission under FCC part 15

Responsible Party : i-SENS, Inc.
43, Banpo-daero 28-gil, Seocho-gu, Seoul 06646,
KOREA, REPUBLIC OF

Contact Person : So Young Kang

Manufacturer : CoaguSense, Inc.
48377 Fremont Blvd., STE. 113 Fremont, CA 94538 USA

- FCC ID: OELPN300107
- Model: P/N 300107
- Brand Name: N/A
- EUT Type: PT/INR Monitoring Meter
- Classification: Part 15 Low Power Communication Device Transmitter (DXX)
- Applied Standard: FCC 47 CFR Part 15.225
- Test Procedure(s): ANSI C63.10-2013
- Dates of Test: December 19, 2020 ~ December 29, 2020
- Place of Test: Nemko Korea Co., Ltd.

2. INTRODUCTION

2.1 Test facility

The measurement procedure described in American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz (ANSI C63.4-2014), the American National Standard for Testing Unlicensed Wireless Devices (ANSI C63.10-2013) was used in determining radiated and conducted emissions emanating from **i-SENS, Inc FCC ID : OELPN300107**.

These measurement tests were conducted at **Nemko Korea Co., Ltd. EMC Laboratory**.

The site address 155 & 159, Osan-Ro, Mohyeon-Eup, Cheoin-Gu, Yongin-Si, Gyeonggi-Do 16885 KOREA, REPUBLIC OF.

The area of Nemko Korea Corporation Ltd. EMC Test Site is located in a mountain area at 80 km (48 miles) southeast and Incheon International Airport (Incheon Airport), 30 km (18miles) south-southeast from central Seoul.

It is located in the valley surrounded by mountains in all directions where ambient radio signal conditions are quiet and a favorable area to measure the radio frequency interference on open field test site for the computing and ISM devices manufactures.

The detailed description of the measurement facility was found to be in compliance with the requirements of ANSI C63.4-2014 according to §2.948.



Nemko Korea Co., Ltd.
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Fig. 1. The map above shows the Seoul in Korea vicinity area.

The map also shows Nemko Korea Corporation Ltd. EMC Lab. and Incheon Airport.

2.2 Accreditation and listing

Accreditation type	Accreditation number
	CAB Accreditation for DOC
	KOLAS Accredited Lab. (Korea Laboratory Accreditation Scheme)
 Industry Canada	Canada IC Registered site
	VCCI registration site(RE/CE/Telecom CE)
	EMC CBTL
	KCC(RRL)Designated Lab.

3. TEST CONDITIONS & EUT INFORMATION

3.1 Operation During Test

The EUT is the NFC device.

The EUT was set to transmit the wanted TX channel continuously.

The operating voltage of EUT was 6.0 Vdc (4 AA batteries).

The worst data were recorded in the report.

3.1.1 Table of test power setting

Frequency	Mode	Power setting Level
13.56 MHz	NFC	Default

3.1.2 Table of test channels

Frequency band	Frequency (MHz)
13.110 ~ 14.010 MHz	13.56

3.1.3 Antenna information

Frequency band	Antenna TX mode	Support CDD	Support MIMO
13.110 ~ 14.010 MHz	■ 1TX, □ 2TX	□ Yes, ■ No	□ Yes, ■ No

3.1.4 Additional Information Related to Testing

For the testing, EUT is set to NFC operation when EUT power is on.

In addition to NFC, approved RF module is below installed.

Product Name	Module Name	FCC ID	Remark
Bluetooth Module	BM001	OELBM001	Bluetooth BLE module

Refer to test report (MPE Report) for compliance for simultaneous-transmission.

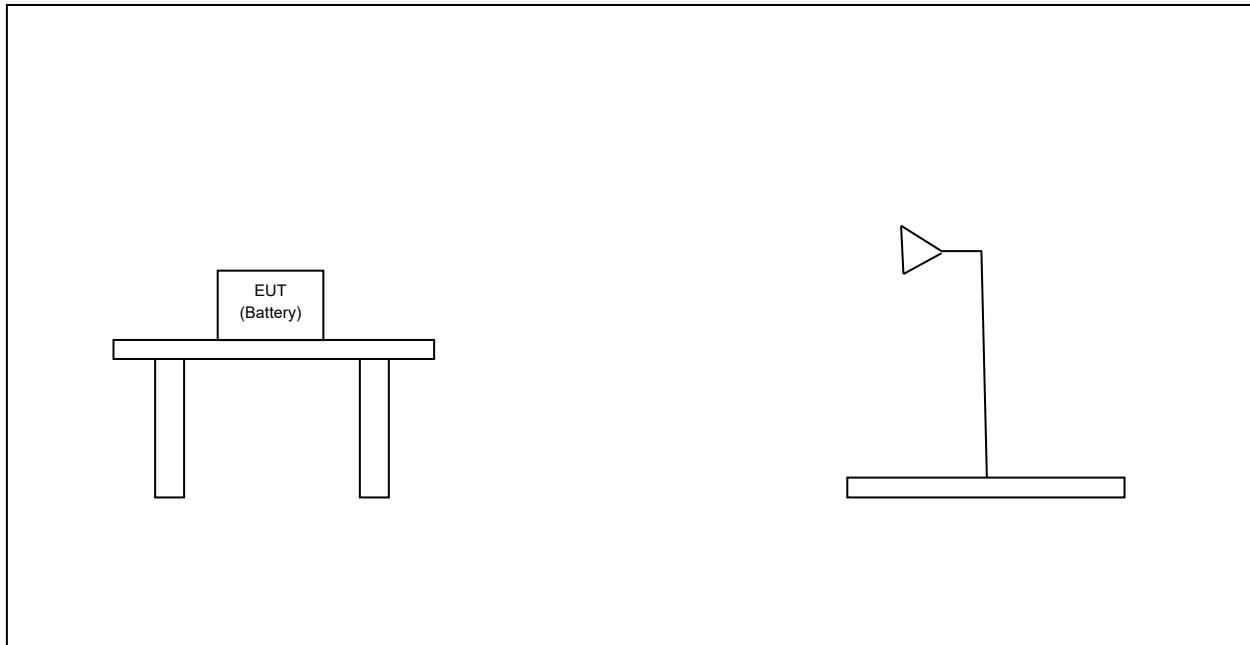
3.1.5 Table of test modes

Test Items	Modulation	Test Frequency (MHz)
Radiated emissions	ASK	13.56
The field strength of any emission within the band 13.110~14.010 MHz	ASK	13.56
20 dB bandwidth	ASK	13.56
Frequency tolerance	ASK	13.56

3.2 Support Equipment

EUT	i-SENS, Inc Model : P/N 300107	S/N: N/A
Laptop Computer	HP Model : G62-355TU 1.5 m shielded pin connector cable	FCC DOC S/N : CNF0489WDT
AC/DC Adapter	HP Model : PPP009D 1.5 m unshielded power cable	FCC DOC S/N: WBGSV0ACXZH162

3.3 Setup Drawing



* Refer to Photographs of Test setup and clause 7, 8 in this report for detail.

3.4 EUT Information

The EUT is the **i-SENS, Inc PT/INR Monitoring Meter** FCC ID: **OELPN300107**.

Specifications:

EUT Type	PT/INR Monitoring Meter
Model Name	P/N 300107
Brand Name	N/A
Frequency of Operation	13.110 MHz ~ 14.010 MHz
Field Strength of Fundamental	10.19 dBuV/m (3.23 uV/m) @ 30m
FCC Classification	Part 15 Low Power Communication Device Transmitter (DXX)
Number of Channels	1 CH
Modulations	ASK
Antenna Setup	1TX / 1RX
EUT Rated Voltage	6.0 Vdc (4 AA batteries)
EUT Test Voltage	6.0 Vdc (4 AA batteries)
Temperature Range	-20 °C ~ +50 °C
Size (W x H x D)	About 100 mm x 150 mm x 30 mm
Weight	About 334 g
Remarks	-

4. SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specification:

Name of Test	FCC Paragraph No.	Result	Remark
Conducted Emission	15.207	N/A	Powered by Battery
Radiated Emission	15.209	Complies	
The Field strength of any emission within the band 13.110~14.010 MHz	15.225(a),(b),(c)	Complies	
20 dB Bandwidth	15.215(c)	Complies	
Frequency Tolerance	15.225(e)	Complies	

5. RECOMMENDATION/CONCLUSION

The data collected shows that the **i-SENS, Inc PT/INR Monitoring Meter**
FCC ID: OELPN300107 is in compliance with Part 15.225 of the FCC Rule.

6. ANTENNA REQUIREMENTS

§15.203 of the FCC Rules part 15 Subpart C

: 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 antenna of the **i-SENS, Inc PT/INR Monitoring Meter** FCC ID: **OELPN300107** is **permanently attached** and there are no provisions for connection to an external antenna. It complies with the requirement of §15.203.

7. DESCRIPTION OF TESTS

7.1 Radiated Emissions

The measurement was performed at the test site that is specified in accordance with ANSI C63.10-2013.

The spurious emission was scanned from 9 kHz to 30 MHz using Loop Antenna (Rohde&Schwarz, HFH2-Z2) and 30 to 1000 MHz using Trilog broadband test antenna(Schwarzbeck, VULB 9163).

For emissions testing at below 1GHz, The test equipment was placed on turntable with 0.8 m above ground. Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The EUT, cable, wire arrangement and mode of operation that has the highest amplitude relative to the limit was selected. Then, the turn table was rotated from 0° to 360° and an antenna mast was moved from 1 m to 4 m height to maximize the suspected highest amplitude signal. The final maximized level was recorded.

At frequencies below 1000 MHz, measurements performed using the CISPR quasi-peak detection. The limit of field strength of any emission within the band 13.110~14.010 MHz is below.

Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
13.553-13.567	15,848	30
13.410-13.553	334	30
13.567-13.710		
13.110-13.410	106	30
13.710-14.010		

Radiated Emissions Limits per 47 CFR 15.225(a)(b)(c)

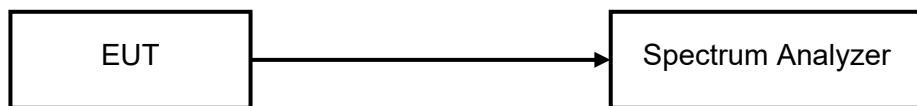
The limit of field strength of any emission outside of the band 13.110~14.010 MHz is below.

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

Radiated Emissions Limits per 47 CFR 15.209(a)

7.2 20 dB Bandwidth

Test Setup



Test Procedure

The EUT is set to the wanted TX channel and connected to the spectrum analyzer.

The spectrum analyzer setting is as follows

Span = approximately 2 to 5 times the 20 dB bandwidth, centered on TX channel

RBW = 1% to 5% of the OBW

VBW = approximately 3 x RBW

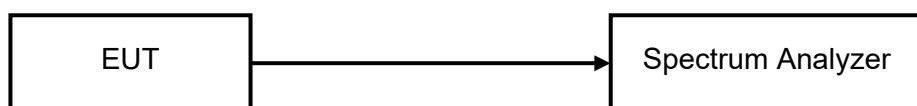
Sweep = auto

Detector = peak

Trace mode = max hold

7.3 Frequency Tolerance

Test Setup



Test Procedure

The EUT is set to the wanted TX channel and connected to the Frequency Counter

8. TEST DATA

8.1 Radiated Emissions

FCC §15.209

Test Mode : Set to wanted TX channel

Result

Frequency (MHz)	Reading (dB μ V/m)	Pol* (H/V)	Antenna Heights (cm)	Turntable Angles (°)	AF+CL+Amp** (dB)	Result (dB μ V/m)	Limit*** (dB μ V/m)	Margin (dB)
2.06	73.85	H	400	137	-23.6	50.3	69.5	19.3
69.50	47.61	V	100	41	-26.4	21.2	40.0	18.8
199.97	50.65	H	300	41	-24.1	26.6	43.5	17.0

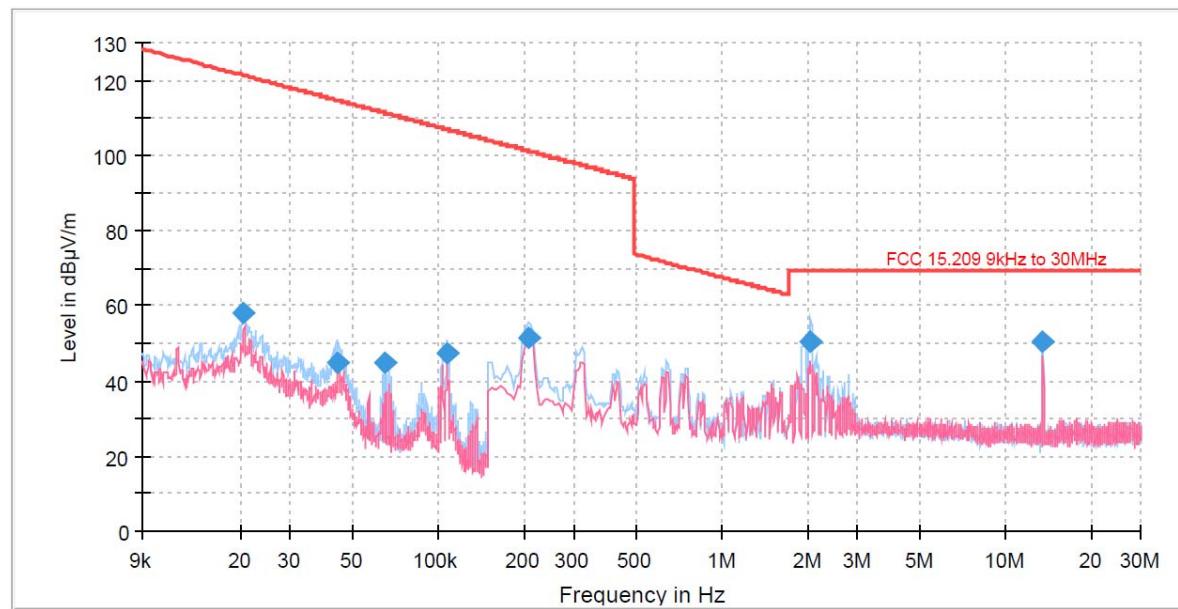
Radiated Measurements at 3meters

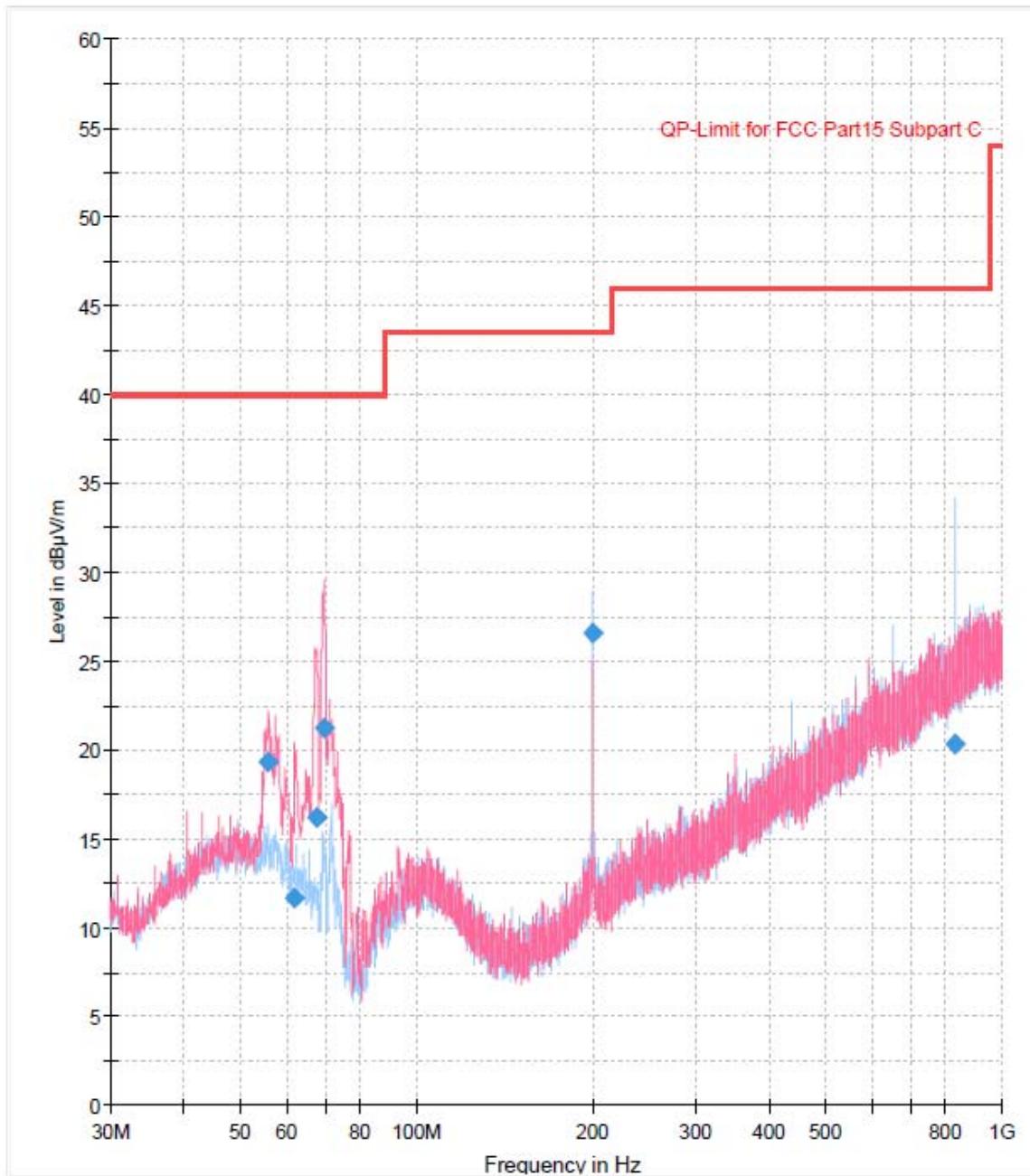
Notes:

1. *Pol. H = Horizontal, V = Vertical
2. **AF + CL + Amp. = Antenna Factor + Cable Loss + Amplifier.
3. ***At frequencies below 30MHz, the limits are extrapolated to 3m measurement distance with correction factor (40 dB/decade) according FCC 15.31(f)(2).
4. Measurements using CISPR quasi-peak mode below 1 GHz.
5. Measured using RBW = 9 kHz, VBW = 30 kHz below 30 MHz.
6. Measured using RBW = 120 kHz, VBW = 300 kHz above 30 MHz.
7. The radiated emissions testing were made by rotating EUT through three orthogonal axes and rotating the receive antenna with horizontal, Vertical polarization. The worst data was recorded.
8. The limit is on the FCC §15.209.
9. Other emissions were greater than 20 dB below the limit.

PLOTS OF EMISSIONS

Radiated Emission_9kHz to 30MHz_13.56MHz



PLOTS OF EMISSIONS**Radiated Emission_30MHz to 1GHz_13.56MHz**

TEST DATA

8.2 The field strength of any emission within the band 13.110~14.010 MHz

FCC §15.225(a),(b),(c)

Test Mode : Set to wanted TX channel

Result

Frequency (MHz)	Reading (dB μ V/m)	Pol* (H/V)	Antenna Heights (cm)	Turntable Angles (°)	AF+CL+Amp** (dB)	Result (dB μ V/m)	Limit*** (dB μ V/m)	Margin (dB)
13.56	73.94	H	400	292	-23.6	50.3	123.9	73.6

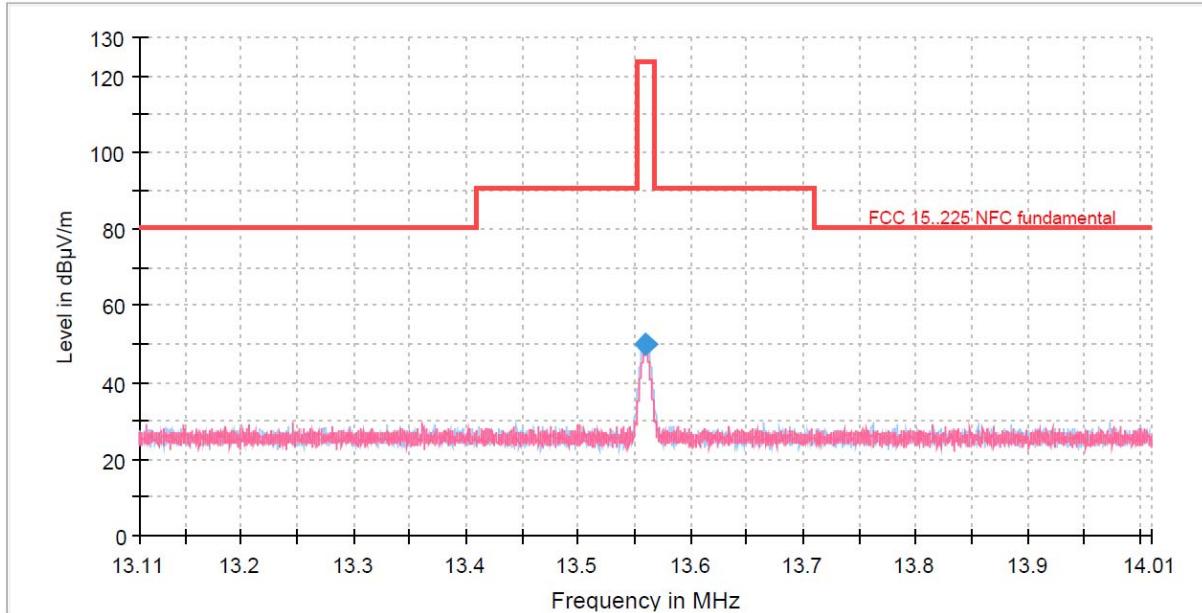
Radiated Measurements at 3meters

Notes:

1. *Pol. H = Horizontal, V = Vertical
2. **AF + CL + Amp. = Antenna Factor + Cable Loss + Amplifier.
3. ***At frequencies below 30MHz, the limits are extrapolated to 3m measurement distance with correction factor (40 dB/decade) according FCC 15.31(f)(2).
4. Measurements using CISPR quasi-peak mode below 1 GHz.
5. Measured using RBW = 9 kHz, VBW = 30 kHz below 30 MHz.
6. The radiated emissions testing were made by rotating EUT through three orthogonal axes and rotating the receive antenna with horizontal, Vertical polarization. The worst data was recorded.
7. The limit is on the FCC §15.209.

PLOTS OF EMISSIONS

The field strength of any emission within the band 13.110~14.010 MHz_13.56MHz



TEST DATA

8.3 20 dB Bandwidth

FCC §15.215(c)

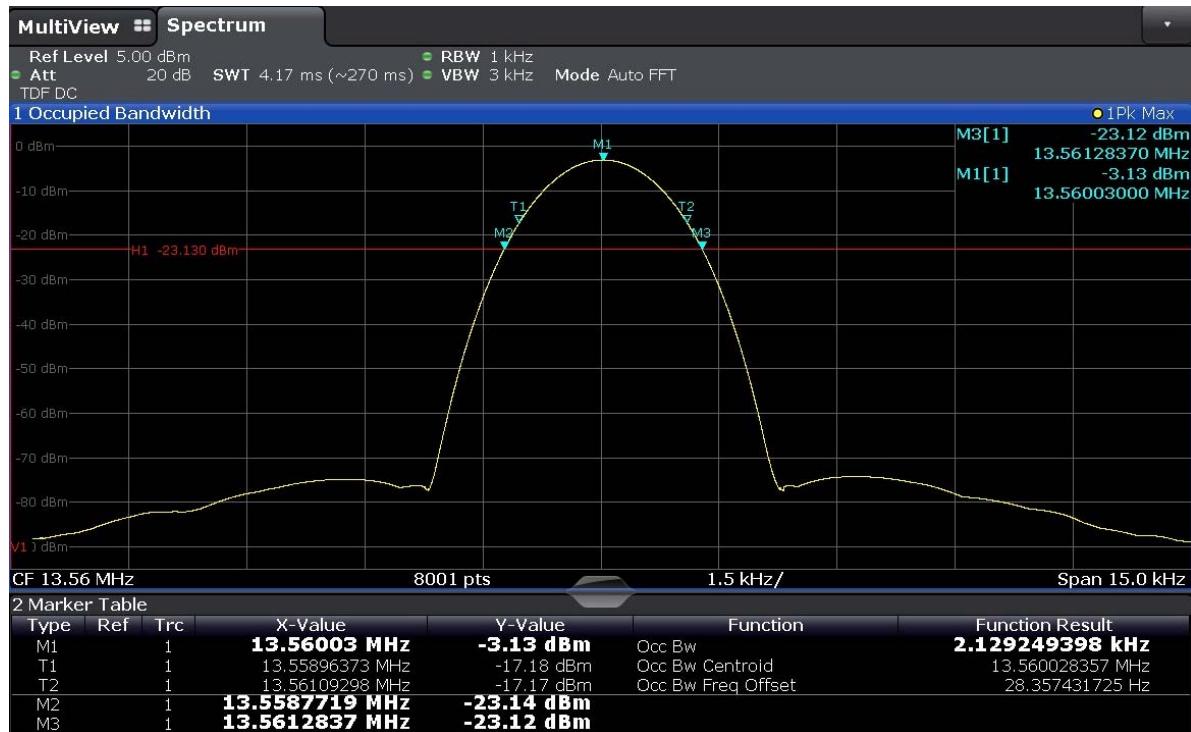
Test Mode : Set to wanted TX channel

Result

Frequency (MHz)	20 dB Bandwidth (MHz)		Limit (MHz)	Margin (MHz)	99% emission Bandwidth (kHz)
13.56	Lowest Edge	13.559	13.110	0.449	2.129
	Highest Edge	13.561	14.010	0.449	

PLOTS OF EMISSIONS

20 dB Bandwidth_13.56MHz



TEST DATA

8.4 Frequency Tolerance

FCC §15.225(e)

Test Mode : Set to wanted TX channel

Result

Frequency (MHz)	Temperature (°C)	Voltage (V)	Time (m)	Measured value (Hz)	Tolerance (Hz)	Limit (Hz)	Result
13.56	50	6.00	0	13559926	74	1356	Pass
			2	13559926	74	1356	Pass
			5	13559924	76	1356	Pass
			10	13559921	79	1356	Pass
	40	6.00	0	13559954	46	1356	Pass
			2	13559953	47	1356	Pass
			5	13559951	49	1356	Pass
			10	13559947	53	1356	Pass
	30	6.00	0	13559940	60	1356	Pass
			2	13559939	61	1356	Pass
			5	13559938	62	1356	Pass
			10	13559936	64	1356	Pass
	20	6.00	0	13559947	53	1356	Pass
			2	13559950	50	1356	Pass
			5	13559951	49	1356	Pass
			10	13559953	47	1356	Pass
	10	6.00	0	13559971	29	1356	Pass
			2	13559972	28	1356	Pass
			5	13559973	27	1356	Pass
			10	13559975	25	1356	Pass
	0	6.00	0	13559987	13	1356	Pass
			2	13559988	12	1356	Pass
			5	13559991	9	1356	Pass
			10	13559993	7	1356	Pass
	-10	6.00	0	13559994	6	1356	Pass
			2	13559993	7	1356	Pass
			5	13559990	10	1356	Pass
			10	13559987	13	1356	Pass
	-20	6.00	0	13559988	12	1356	Pass
			2	13559987	13	1356	Pass
			5	13559985	15	1356	Pass
			10	13559982	18	1356	Pass

Note:

1. Battery voltage

9. TEST EQUIPMENT

No.	Instrument	Manufacturer	Model	Serial No.	Calibration Date	Calibration Interval
1	*Test Receiver	R & S	ESU 40	100202	Apr. 02 2020	1 year
2	Test Receiver	R & S	ESCI	101041	Apr. 02 2020	1 year
3	*Attenuator	FAIRVIEW	SA3N5W-06	N/A	Apr. 03 2020	1 year
4	Attenuator	FAIRVIEW	SA3N5W-10	N/A	Jul. 13 2020	1 year
5	*Attenuator	API technologies	40A2W-10	1913	Apr. 03 2020	1 year
6	*Amplifier	R & S	SCU 01	10029	Apr. 02 2020	1 year
7	Amplifier	R & S	SCU18	10065	Apr. 02 2020	1 year
8	Amplifier	R & S	SCU26D	1984522	Apr. 03 2020	1 year
9	Amplifier	R & S	SCU40	100380	Jul. 14 2020	1 year
10	Spectrum Analyzer	KEYSIGHT	N9030B	MY57144248	Jun. 05 2020	1 year
11	Spectrum Analyzer	Agilent	E4440A	MY44022567	Oct. 12 2020	1 year
12	*Spectrum Analyzer	R & S	FSW43	100732	Mar. 24 2020	1 year
13	*Loop Antenna	R & S	HFH2-Z2	100279	Mar. 25 2020	2 year
14	Horn Antenna	R & S	HF907	102585	Jul. 16 2020	1 year
15	Horn Antenna	Q-par Angus	QMS-00225	17637	Sep. 22 2020	1 year
16	Horn Antenna	Q-par Angus	QSH22K20	8180	Sep. 22 2020	1 year
17	*Trilog-Broadband Antenna	SCHWARZBECK	VULB 9163	946	Jul. 11 2019	2 year
18	LISN	R & S	ENV216	101156	Oct. 12 2020	1 year
19	Position Controller	INNCO	CO2000	12480406/L	N/A	N/A
20	*Controller	INNCO	CO3000	CO3000/937/38330516/I	N/A	N/A
21	Turn Table	INNCO	DS1200S	N/A	N/A	N/A
22	*Turn Table	INNCO	DT2000-2t	N/A	N/A	N/A
23	*Antenna Mast	INNCO	MA4000	N/A	N/A	N/A
24	*TILT Antenna Mast	INNCO	MA4640-XP-EP	N/A	N/A	N/A
25	Open Switch And Control Unit	R & S	OSP-120	100081	N/A	N/A
26	*Open Switch And Control Unit	R & S	OSP-120	101766	N/A	N/A
27	Shielded Room	Seo-Young EMC	N/A	N/A	N/A	N/A
28	*Anechoic Chamber	Seo-Young EMC	N/A	N/A	N/A	N/A
29	WiFi Filter Bank	R & S	U083	N/A	N/A	N/A
30	WiFi Filter Bank	R & S	U082	N/A	N/A	N/A

*) Test equipment used during the test

10. ACCURACY OF MEASUREMENT

The Measurement Uncertainties stated were calculated in accordance with the requirements of measurement uncertainty contained in CISPR 16-4-2 with the confidence level of 95%

1. Conducted Uncertainty Calculation

Source of Uncertainty	Xi	Uncertainty of Xi		Coverage factor k	$u(Xi)$ (dB)	Ci	$Ci u(Xi)$ (dB)
		Value (dB)	Probability Distribution				
Receiver reading	RI	± 0.1	normal 1	1.000	0.1	1	0.1
Attenuation AMN-Receiver	LC	± 0.08	normal 2	2.000	0.04	1	0.04
AMN Voltage division factor	$LAMN$	± 0.8	normal 2	2.000	0.4	1	0.4
Sine wave voltage	$dVSW$	± 2.00	normal 2	2.000	1.00	1	1.00
Pulse amplitude response	$dVPA$	± 1.50	rectangular	1.732	0.87	1	0.87
Pulse repetition rate response	$dVPR$	± 1.50	rectangular	1.732	0.87	1	0.87
Noise floor proximity	$dVNF$	± 0.00	-	-	0.00	1	0.00
AMN Impedance	dZ	± 1.80	triangular	2.449	0.73	1	0.73
① Mismatch	M	+ 0.70	U-Shaped	1.414	0.49	1	0.49
② Mismatch	M	- 0.80	U-Shaped	1.414	- 0.56	1	- 0.56
Measurement System Repeatability	RS	0.05	normal 1	1.000	0.05	1	0.05
Remark	①: AMN-Receiver Mismatch : + ②: AMN-Receiver Mismatch : -						
Combined Standard Uncertainty	Normal			± 1.88			
Expended Uncertainty U	Normal ($k = 2$)			± 3.76			

2. Radiation Uncertainty Calculation

Source of Uncertainty	Xi	Uncertainty of Xi		Coverage factor k	$u(Xi)$ (dB)	Ci	$Ci u(Xi)$ (dB)
		Value (dB)	Probability Distribution				
Measurement System Repeatability	RS	0.34	normal 1	1.00	0.34	1	0.34
Receiver reading	Ri	± 0.02	normal 2	2.00	0.01	1	0.01
Sine wave voltage	$dVsw$	± 0.17	normal 2	2.00	0.09	1	0.09
Pulse amplitude response	$dVpa$	± 0.92	normal 2	2.00	0.46	1	0.46
Pulse repetition rate response	$dVpr$	± 0.35	normal 2	2.00	0.18	1	0.18
Noise floor proximity	$dVnf$	± 0.50	normal 2	2.00	0.25	1	0.25
Antenna Factor Calibration	AF	± 2.00	rectangular	$\sqrt{3}$	1.15	1	1.15
Cable Loss	CL	± 1.00	normal 2	2.00	0.50	1	0.50
Antenna Directivity	AD	± 0.00	rectangular	$\sqrt{3}$	0.00	1	0.00
Antenna Factor Height Dependence	AH	± 2.00	rectangular	$\sqrt{3}$	1.15	1	1.15
Antenna Phase Centre Variation	AP	± 0.20	rectangular	$\sqrt{3}$	0.12	1	0.12
Antenna Factor Frequency Interpolation	Ai	± 0.25	rectangular	$\sqrt{3}$	0.14	1	0.14
Site Imperfections	Si	± 4.00	triangular	$\sqrt{6}$	1.63	1	1.63
Measurement Distance Variation	DV	± 0.60	rectangular	$\sqrt{3}$	0.35	1	0.35
Antenna Balance	$Dbal$	± 0.90	rectangular	$\sqrt{3}$	0.52	1	0.52
Cross Polarisation	$DCross$	± 0.00	rectangular	$\sqrt{3}$	0.00	1	0.18
Mismatch	M	$+ 0.98$ $- 1.11$	U-Shaped	$\sqrt{2}$	0.74	1	0.74
EUT Volume Diameter	Vd	0.33	normal 1	1.00	0.33	1	0.11
Remark							
Combined Standard Uncertainty	Normal						
Expended Uncertainty U	Normal ($k = 2$)						