

Nemko Korea Co., Ltd.

159, Osan-ro, Mohyeon-Eup, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea

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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. : Da Yun Lee

Dates of Issue : March 9, 2018
Test Report No. : NK-18-R-037
Test Site : Nemko Korea Co., Ltd.

FCC ID

OELPN200107

Brand Name

i-SENS, Inc

Contact Person

i-SENS, Inc
43, Banpo-daero 28-gil, Seocho-gu, Seoul 06646,
Korea, republic of
Da Yun Lee
Telephone No. : 82-10-9788-8513

Applied Standard: FCC 47 CFR Part 15.225

Classification: Part 15 Low Power Communication Device Transmitter (DXX)

EUT Type: Prothrombin Time/INR Monitoring System

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.



Tested By : Seungyong Shin
Engineer



Reviewed By : Deokha Ryu
Technical Manager

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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 : Da Yun Lee

Manufacturer : i-SENS, Inc
43, Banpo-daero 28-gil, Seocho-gu, Seoul 06646, Korea, republic of

- FCC ID: OELPN200107
- Model: P/N 200107
- Brand Name: i-SENS, Inc
- EUT Type: Prothrombin Time/INR Monitoring System
- Classification: Part 15 Low Power Communication Device Transmitter (DXX)
- Applied Standard: FCC 47 CFR Part 15.225
- Test Procedure: ANSI C63-10-2013
- Dates of Test: February 28, 2017 ~ March 8, 2017
- 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 : OELPN200107**.

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

The site address is 159, Osan-ro, Mohyeon-Eup, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea.

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.



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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 Designation No. KR0026
	KOLAS Accredited Lab. (Korea Laboratory Accreditation Scheme) Registration No. 155
 Industry Canada	Canada IC Registered site Site No. 2040E
	VCCI registration site(RE/CE/Telecom CE) Member No. 2118
	EMC CBTL -
	KCC(RRL)Designated Lab. Registration No. KR0026

3. TEST CONDITIONS & EUT INFORMATION

3.1 Operation During Test

The EUT is the RFID device.

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

The operating voltage of EUT is 3.7 Vdc (Rechargeable Lithium polymer battery).

The worst data were recorded in the report.

3.1.1 Table of test power setting

Frequency (MHz)	Mode	Power setting Level
13.56	RFID	Default

3.1.2 Table of test channels

Frequency band (MHz)	Frequency (MHz)
13.110~14.010	13.56

3.1.3 Antenna information

Frequency band (MHz)	Antenna TX mode	Support CDD	Support MIMO
13.110~14.010	<input checked="" type="checkbox"/> 1TX, <input type="checkbox"/> 2TX	<input type="checkbox"/> Yes, <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes, <input checked="" type="checkbox"/> No

3.1.4. Additional Information Related to Testing

RF module approved as below are installed in this device.

Product Type	Module Name	Remark
Wi-Fi/BT Transceiver	Sterling-LWB5	FCC ID : TFB-1004

3.1.5 Table of test modes

Test Items	Modulation	Test channel (CH)
Radiated emissions	ASK	1
The field strength of any emission within the band 13.110~14.010 MHz	ASK	1
20 dB bandwidth	ASK	1
Frequency tolerance	ASK	1

3.2 Support Equipment

EUT	i-SENS, Inc Model : P/N 200107	S/N: N/A
Laptop Computer	N/A	S/N: N/A
AC/DC Adapter	N/A	S/N: N/A

3.3 Setup Drawing

EUT could be set to transmit without jig and power cable.

P/N 200107 (EUT)
with battery

* Refer to Photographs of Test setup for detail.

3.4 EUT Information

The EUT is the **i-SENS, Inc Prothrombin Time/INR Monitoring System FCC ID: OELPN200107**.

Specifications:

EUT Type	Prothrombin Time/INR Monitoring System
Model Name	P/N 200107
Brand Name	i-SENS, Inc
Frequency of Operation	13.110 MHz ~ 14.010 MHz
Field Strength of Fundamental	4.3 dBuV/m (1.64 uV/m) @ 30m
FCC Classification	Part 15 Low Power Communication Device Transmitter (DXX)
Number of Channels	1 CH
Modulations	ASK
Antenna Setup	1TX / 1RX
Voltage	3.7 Vdc (Rechargeable Lithium polymer battery)
Temperature Range	-20 °C ~ +50 °C
Size (L x W x H)	About 150 mm x 100 mm x 30 mm
Weight	About 316 g
Remarks	-

4. SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specification:

Test Requirement	FCC Paragraph No.	Result	Remark
Radiated emissions	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 Prothrombin Time/INR Monitoring System FCC ID: OELPN200107** is in compliance with Part 15.225 of the FCC.

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 Prothrombin Time/INR Monitoring System FCC ID: OELPN200107** 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)

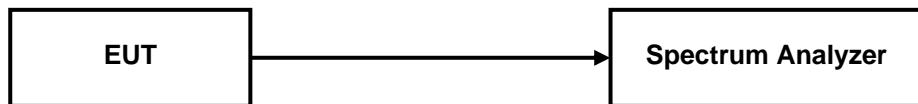
The limit of field strength of any emission outside of the band 13.110~14.010 MHz is below.

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

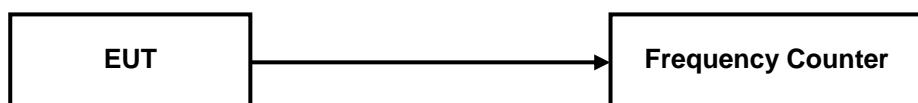
Sweep = auto

Detector function = peak

Trace = 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

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)
0.10	15.02	H	100	294	19.6	34.6	107.3	72.7
0.21	18.98	H	100	283	19.5	38.5	101.0	62.6
1.62	15.13	H	100	175	19.3	34.4	63.4	29.0
2.07	21.55	H	100	4	19.3	40.9	69.5	28.7
663.75	58.08	V	100	63	-20.2	37.9	46.0	8.1
686.30	53.17	V	100	62	-19.9	33.3	46.0	12.7
708.76	59.53	V	100	252	-19.7	39.8	46.0	6.2

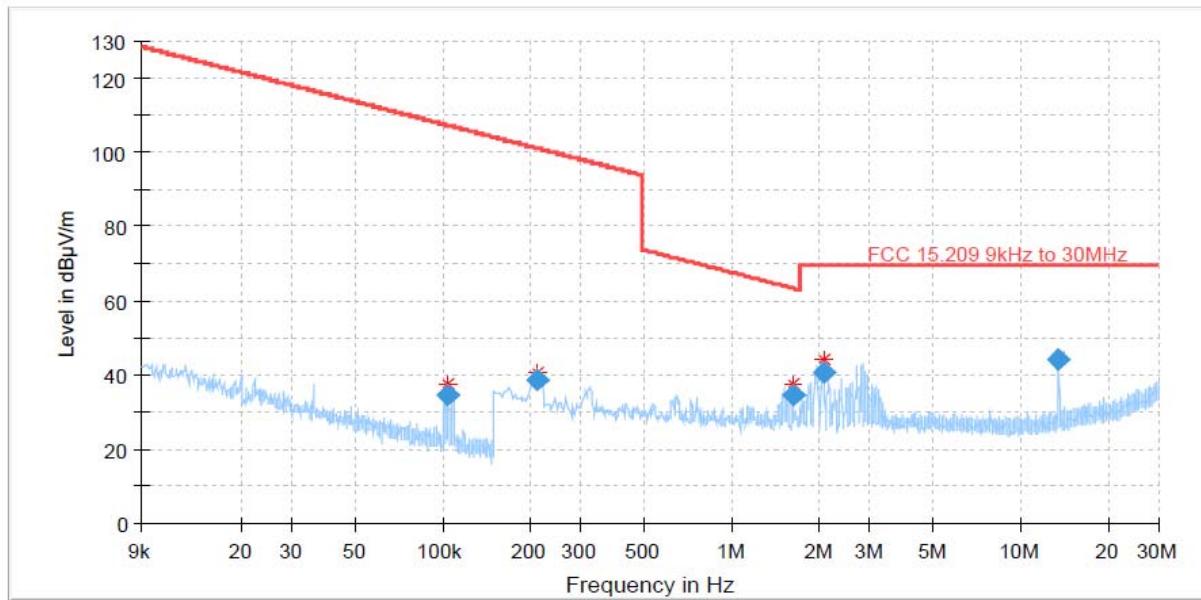
Radiated Measurements at 3meters

Notes:

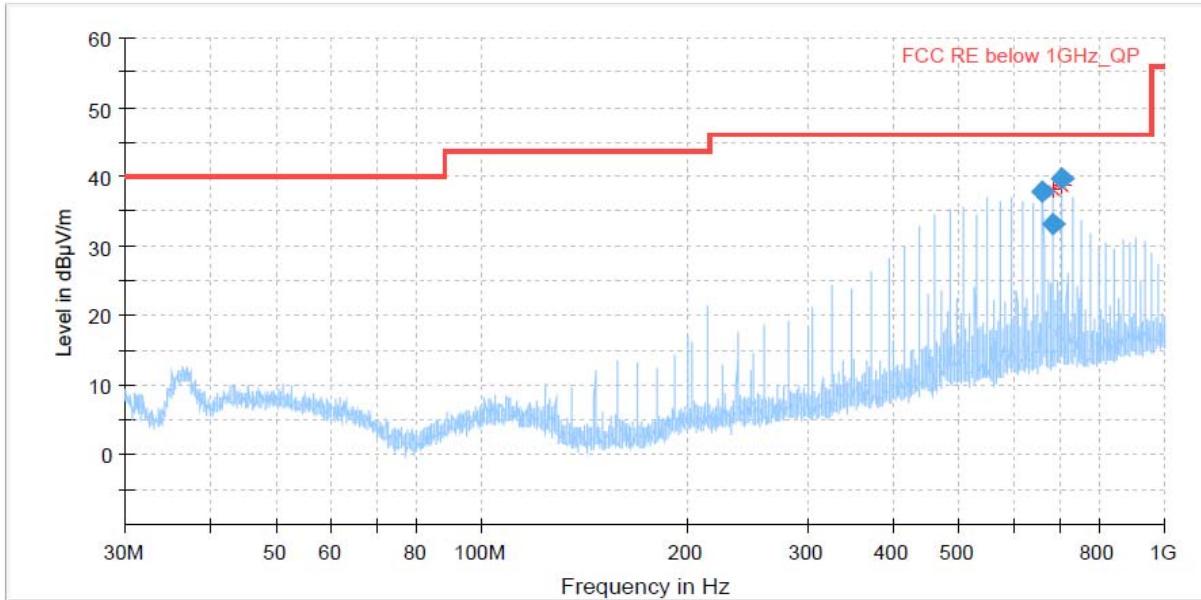
1. *Pol. H = Horizontal, V = Vertical
2. **AF + CL + Amp. = Antenna Factor + Cable Loss + Amplifier.
3. ***At frequencies below 30MHz, the limits are extrapolated to 3m measurement distance with correction factor (40 dB/decade) according FCC 15.31(f)(2).
4. Measurements using CISPR quasi-peak mode below 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.

PLOTS OF EMISSIONS

Radiated emission_ 9kHz to 30MHz_ 13.56MHz



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

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	23.86	H	100	86	20.4	44.3	123.8	79.5

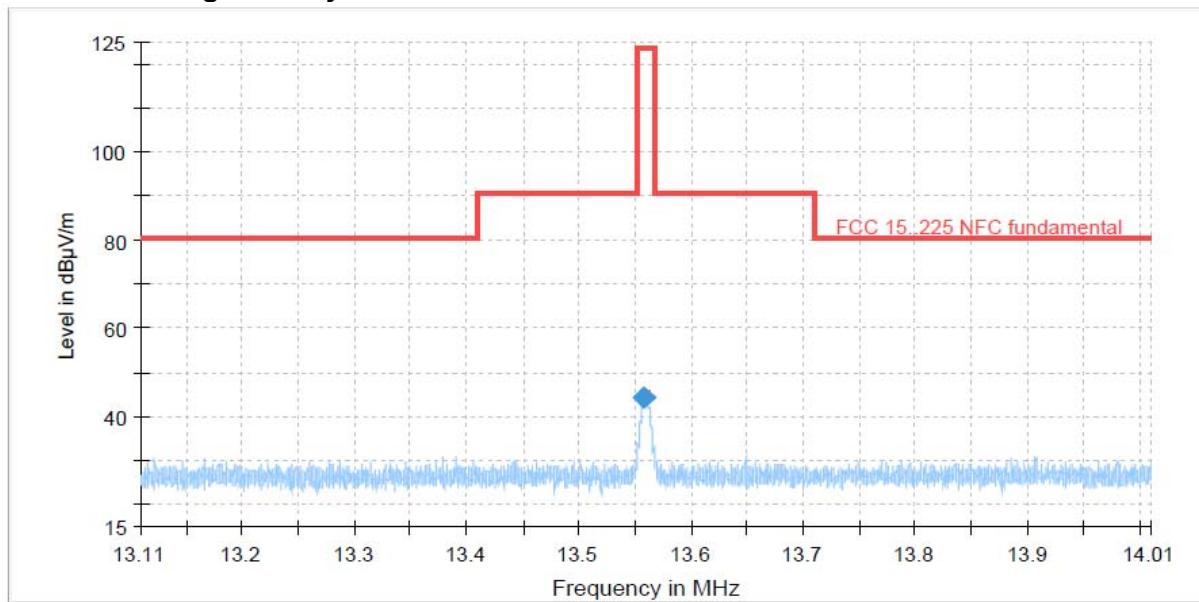
Radiated Measurements at 3meters

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



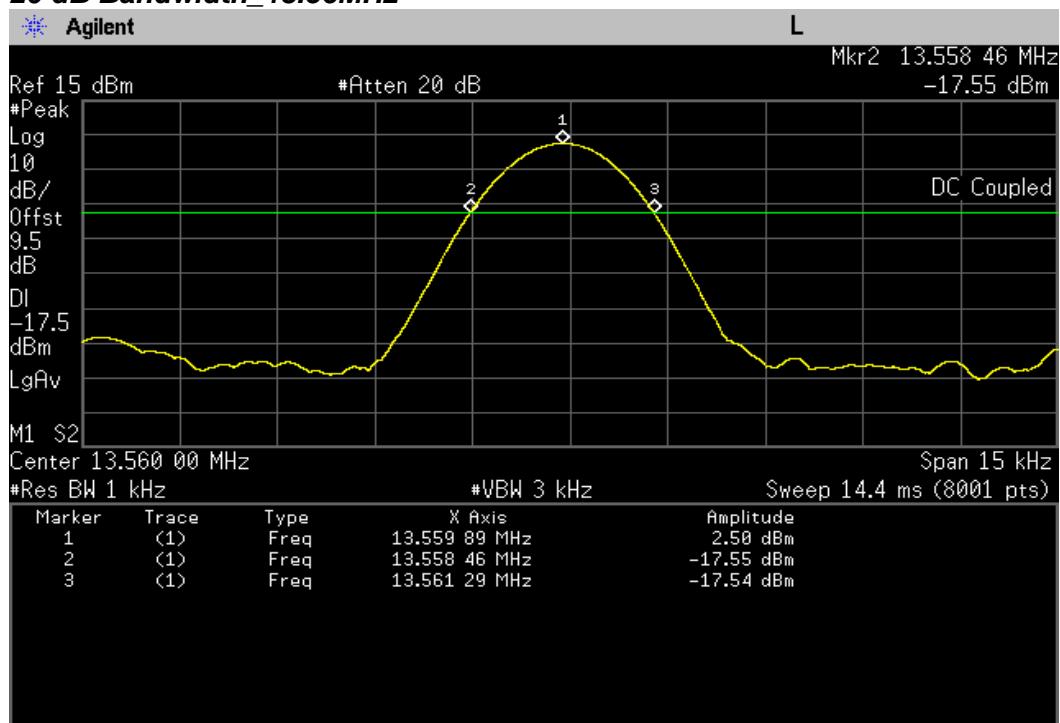
TEST DATA

8.3 20 dB Bandwidth**FCC §15.215(c)****Test Mode : Set to wanted TX channel**

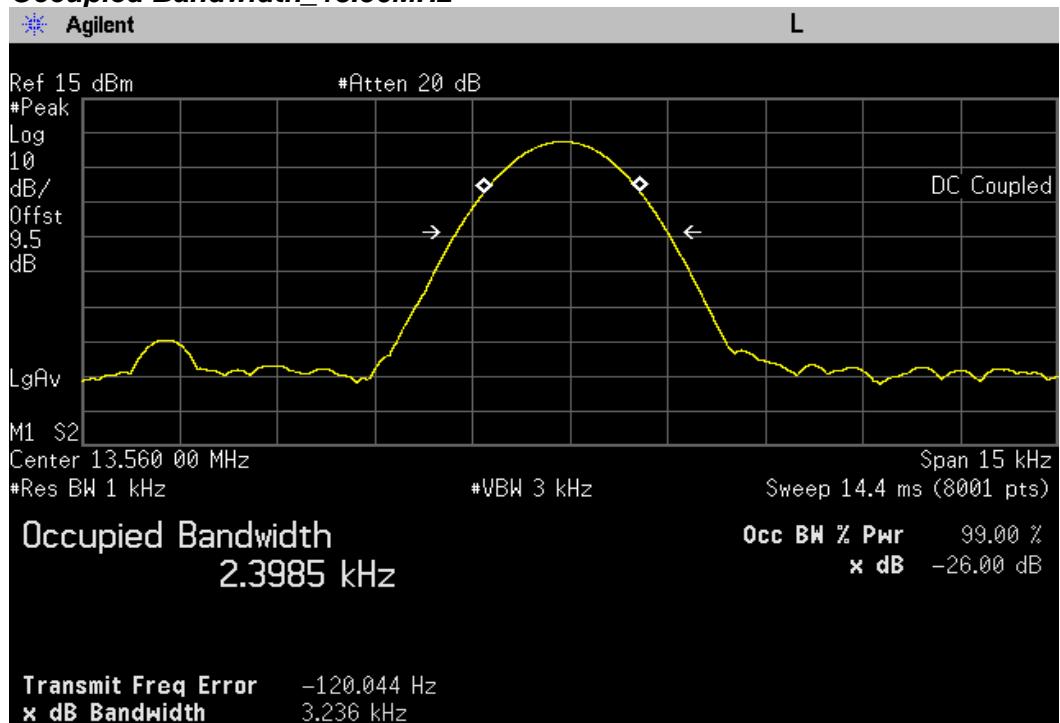
Frequency (MHz)	20 dB Bandwidth (MHz)		Limit (MHz)	Margin (MHz)
13.56	Lowest Edge	13.55846	13.110	0.448
	Highest Edge	13.56129	14.010	0.449

PLOTS OF EMISSIONS

20 dB Bandwidth_13.56MHz



Occupied Bandwidth_13.56MHz



TEST DATA

8.4 Frequency tolerance

FCC §15.225(e)

Test Mode : Set to wanted TX channel

Frequency (MHz)	Temperature (°C)	Voltage* (V)	Time (m)	Measured value (Hz)	Tolerance (Hz)	Limit (Hz)	Result
13.56	50	3.7	0	13559860	140	1356	Pass
			2	13559856	144	1356	Pass
			5	13559852	148	1356	Pass
			10	13559848	152	1356	Pass
	40	3.7	0	13559910	90	1356	Pass
			2	13559894	106	1356	Pass
			5	13559890	110	1356	Pass
			10	13559880	120	1356	Pass
	30	3.7	0	13559949	51	1356	Pass
			2	13559937	63	1356	Pass
			5	13559923	77	1356	Pass
			10	13559915	85	1356	Pass
	20	3.7	0	13559902	98	1356	Pass
			2	13559899	101	1356	Pass
			5	13559899	101	1356	Pass
			10	13559898	102	1356	Pass
	10	3.7	0	13559979	21	1356	Pass
			2	13559976	24	1356	Pass
			5	13559971	29	1356	Pass
			10	13559969	31	1356	Pass
	0	3.7	0	13559982	18	1356	Pass
			2	13559982	18	1356	Pass
			5	13559982	18	1356	Pass
			10	13559981	19	1356	Pass
	-10	3.7	0	13559974	26	1356	Pass
			2	13559977	23	1356	Pass
			5	13559978	22	1356	Pass
			10	13559979	21	1356	Pass
	-20	3.7	0	13559939	61	1356	Pass
			2	13559946	54	1356	Pass
			5	13559949	51	1356	Pass
			10	13559952	48	1356	Pass

Notes:

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. 04 2017	1 year
2	Test Receiver	R & S	ESCS30	100302	Oct. 12 2017	1 year
3	*Attenuator	PASTERNACK	PE7395-10	1441-1	Jul. 13 2017	1 year
4	Attenuator	FAIRVIEW	SA3N5W-06	N/A	Jan. 08 2018	1 year
5	Attenuator	FAIRVIEW	SA3N5W-10	N/A	Apr. 03 2017	1 year
6	*Attenuator	WEINSCHEL	56-10	58765	Oct. 10 2017	1 year
7	*Amplifier	R & S	SCU 01	10029	Apr. 03 2017	1 year
8	Amplifier	R & S	SCU18F	180025	Apr. 03 2017	1 year
9	Amplifier	R & S	SCU26	10011	Jul. 13 2017	1 year
10	Amplifier	R & S	SCU40	100380	Jul. 13 2017	1 year
11	Pre Amplifier	HP	8449B	3008A00107	Jan. 08 2018	1 year
12	Spectrum Analyzer	R & S	FSW43	100732	Apr. 11 2017	1 year
13	*Spectrum Analyzer	Agilent	E4440A	MY44303257	Oct. 13 2017	1 year
14	Spectrum Analyzer	R & S	FSW43	104084	Apr. 04 2017	1 year
15	*Loop Antenna	R & S	HFH2-Z2	100279	Feb. 13 2017	2 year
16	Horn Antenna	SCHWARZBECK	BBHA9120D	9120D-508	Feb. 13 2017	2 year
17	Horn Antenna	Q-par Angus	QSH20S20	8179	Aug. 01 2017	2 year
18	Horn Antenna	Q-par Angus	QSH22K20	8180	Aug. 02 2017	2 year
19	*Trilog-Broadband Antenna	SCHWARZBECK	VULB 9163	946	Mar. 13 2017	2 year
20	LISN	R & S	ESH3-Z5	833874/006	Oct. 12 2017	1 year
21	ESH2-Z5 Artificial Mains Network	R & S	ESH2-Z5	100227	Apr. 04 2017	1 year
22	Position Controller	INNCO	CO2000	12480406/L	N/A	N/A
23	*Controller	INNCO	CO3000	CO3000/937/38330516/L	N/A	N/A
24	Turn Table	INNCO	DS1200S	N/A	N/A	N/A
25	*Turn Table	INNCO	DT2000-2t	N/A	N/A	N/A
26	Antenna Mast	INNCO	MA4000	N/A	N/A	N/A
27	*TILT Antenna Mast	INNCO	MA4640-XP-EP	N/A	N/A	N/A
28	Open Switch And Control Unit	R & S	OSP-120	100081	N/A	N/A
29	*Open Switch And Control Unit	R & S	OSP-120	101766	N/A	N/A
30	Shielded Room	Seo-Young EMC	N/A	N/A	N/A	N/A
31	*Anechoic Chamber	Seo-Young EMC	N/A	N/A	N/A	N/A
32	WiFi Filter Bank	R & S	U083	N/A	N/A	N/A
33	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	<i>Xi</i>	Uncertainty of <i>Xi</i>		Coverage factor <i>k</i>	<i>u(Xi)</i> (dB)	<i>Ci</i>	<i>Ci u(Xi)</i> (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 (<i>k</i> = 2)						