RADIO PERFORMANCE TEST REPORT

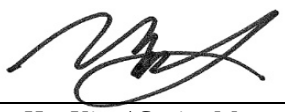
Test Report No.	**: OT-205-RWD-060**
AGR No.	**: A204A-242**
Applicant	**: SEONG JI INDUSTRIAL CO., LTD**
Address	**: 54-33, Dongtanhana 1-gil, Gyeonggi-do, Hwaseong-si, South Korea**
Manufacturer	**: SEONG JI INDUSTRIAL CO., LTD**
Address	**: 54-33, Dongtanhana 1-gil, Gyeonggi-do, Hwaseong-si, South Korea**
Type of Equipment	**: Asset Tracker**
Model Name	**: IET10MO**
Multiple Model Name	**: N/A**
Serial number	**: N/A**
Total page of Report	**: 20 pages (including this page)**
Date of Incoming	**: May 20, 2020**
Date of issue	**: May 29, 2020**

SUMMARY

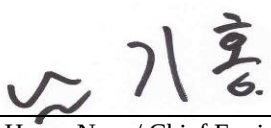
The equipment complies with the standard; EN 300 220-1 V3.1.1 and EN 300 220-2 V3.2.1

This test report only contains the result of a single test of the sample supplied for the examination.

It is not a generally valid assessment of the features of the respective products of the mass-production.

Reviewed by: 

Tae-Ho, Kim / Senior Manager
ONETECH Corp.

Approved by: 

Ki-Hong, Nam / Chief Engineer
ONETECH Corp.

ONETECH Corp.: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

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Revision History

Rev. No.	Issue Report No.	Issued Date	Revisions	Section Affected
0	OT-205-RWD-060	May 29, 2020	Initial Release	All

* Please contact us (e-mail: info@onetech.co.kr) for verification of this test report.

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1. APPLICANT AND MANUFACTURER INFORMATION

-. Applicant : SEONG JI INDUSTRIAL CO., LTD

-. Address : 54-33, Dongtanhana 1-gil, Gyeonggi-do, Hwaseong-si, South Korea

-. Manufacturer : SEONG JI INDUSTRIAL CO., LTD

-. Address : 54-33, Dongtanhana 1-gil, Gyeonggi-do, Hwaseong-si, South Korea

2. TEST SUMMARY

2.1 Test standards and results

CLAUSE	TEST ITEMS	RESULTS	REMARK
All equipment parameters			
5.1	Operating frequency	-	Note1
5.9	Unwanted emissions in the spurious domain	PASS	
Transmitter parameters			
5.2	Effective Radiated Power	-	Note1
5.3	Maximum e.r.p. power spectral density	-	Note1
5.4	Duty Cycle	-	Note1
5.6	Occupied Bandwidth	-	Note1
5.8	Tx Out of Band Emissions	-	Note1
5.10	Transient power	-	Note1
5.11	Adjacent Channel power	-	Note1
5.12	TX behaviour under Low Voltage Conditions	-	Note1
5.13	Adaptive Power Control	-	Note1
Receiver parameters			
5.14	Rx sensitivity	-	Note1
5.18	Blocking	PASS	
Polite spectrum access parameters			
5.21.2	Clear channel assessment threshold	-	Note1
5.21.3	Polite spectrum access timing parameters	-	Note1
5.21.4	Adaptive Frequency Agility	-	Note1

Note1 - The EUT have a RF Test already approved. (Model: SRM200A / Report Number: HCT-RF-1911-CE015)

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2.2 Additions, deviations, exclusions from standards

No additions, deviations or exclusions have been made from standard.

2.3 Purpose of the test

To determine whether the equipment under test fulfills the RF spectrum electro magnetic compatibility requirements of the standards stated in section 2.1.

2.4 Test Facility

The Onetech Corp. has been designated to perform equipment testing in compliance with ISO/IEC 17025.

The Electromagnetic compatibility measurement facilities are located at 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea.

-. Site Filing:

VCCI (Voluntary Control Council for Interference) – Registration No. R-4112/ C-14617/ G-10666/ T-11842

ISED (Innovation, Science and Economic Development Canada) – Registration No. Site# 3736A-3

KOLAS (Korea Laboratory Accreditation Scheme) - Accreditation NO. KT085

FCC (Federal Communications Commission) - Accreditation No. KR0013

RRA (Radio Research Agency) – Designation No. KR0013

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3. EUT (Equipment Under Test)

3.1 Identification of EUT

-. Equipment : Asset Tracker

-. Model Name : IET10MO

-. Brand Name : -

-. Serial number : N/A

-. Manufacturer : SEONG JI INDUSTRIAL CO., LTD

3.2 Additional information about the EUT

The SEONG JI INDUSTRIAL CO., LTD, Model IET10MO (referred to as the EUT in this report) is a Asset Tracker. The product specification described herein was obtained from product data sheet or user's manual. .

DEVICE TYPE	Asset Tracker	
Temperature Range	-30 °C ~ 60 °C	
OPERATING FREQUENCY	Sig Fox	868.034 MHz ~ 868.226 MHz (Tx) 869.429 MHz ~ 869.621 MHz (Rx)
	GPS	1 559 MHz ~ 1 610 MHz
	Bluetooth LE	2 402 MHz ~ 2 480 MHz
	WLAN 2.4 GHz	2 412 MHz ~ 2 472 MHz (802.11b/g/n(HT20))
MODULATION TYPE	Sig Fox	DBPSK
	Bluetooth LE	GFSK
	WLAN 2.4 GHz	802.11b: DSSS Modulation(DBPSK/DQPSK/CCK) 802.11g/n(HT20): OFDM Modulation(BPSK/QPSK/16QAM/64QAM)
ANTENNA TYPE		Sig Fox : Metal Antenna Bluetooth LE / WLAN 2.4 GHz : Chip Antenna GPS : Ceramic Patch Antenna
ANTENNA GAIN		Sig Fox: 2.50 dBi Bluetooth LE: 2.50 dBi WLAN 2.4 GHz: 2.50 dBi
List of each Osc. or crystal Freq.(Freq. >= 1 MHz)		32.768 kHz, 26 MHz, 32 MHz

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3.3 Peripheral equipment

-. None

3.4 Mode of operation during the test

For SigFox function testing, software used to control the EUT for staying in continuous transmitting and receiving mode is programmed. For final testing, the EUT was set at Low Channel (868.055 MHz), Middle Channel (868.130 MHz), and High Channel (868.205 MHz). To get a maximum emission levels from the EUT, the EUT was moved throughout the XY, XZ, and YZ planes and the worst case is “XY” axis.

3.5 Alternative type(s)/model(s); also covered by this test report.

-. None

4. EUT MODIFICATIONS

-. None

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5. Unwanted emissions in the spurious domain

5.1 Operating environment

Temperature : 24 °C

Relative humidity : 49 % R.H.

5.2 Test set-up

EN 300 220-1 V3.1.1 clause 5.9

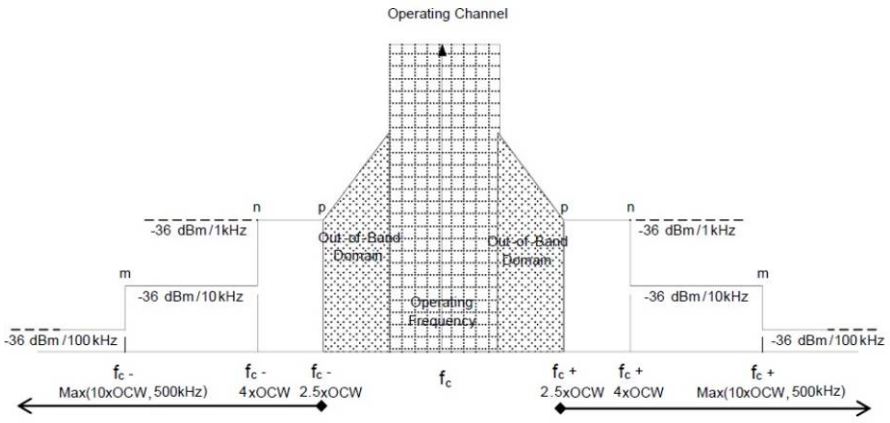
5.3 Measurement uncertainty

The Unwanted emissions in the spurious domain is ± 3.0 dB.

5.4 Description

Subclause: 5.9.1 of ETSI EN 300 220-1 V3.1.1

Spurious emissions are unwanted emissions in the spurious domain at frequencies other than those of the Operating Channel and its Out Of Band Domain. The relevant spurious domain is shown in Figure 7.



5.5 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal.(Interval)
■ -	FSV40	Rohde & Schwarz	Signal Analyzer	101009	Feb. 21, 2020 (1Y)
■ -	OSP120	Rohde & Schwarz	Open Switch and Control Unit	101364	N/A
■ -	OSP150	Rohde & Schwarz	Open Switch and Control Unit	100871	N/A
■ -	Controller CO 2000	Innco systems GmbH	Digital Controller	N/A	N/A
■ -	VULB9163	Schwarzbeck	TRILOG Broadband Antenna	777	Apr. 08, 2020 (2Y)
☐ -	DT3000	Innco System	Turn Table	930611	N/A
■ -	BBHA 9120D	Schwarzbeck	Horn Antenna	9120D-1366	Jul. 16, 2019 (1Y)
☐ -	BBHA 9170	Schwarzbeck	Horn Antenna	BBHA9170179	Jan. 07, 2020 (1Y)
☐ -	QMS-00208	Schwarzbeck	Horn Antenna	16111	Nov. 25, 2019 (1Y)
■ -	MA 2000	Innco systems GmbH	Antenna master	N/A	N/A
■ -	AS1700-EP	Innco systems GmbH	Antenna master	N/A	N/A
■ -	DS 1200 S	Innco systems GmbH	Turn table	N/A	N/A
☐ -	FPA3-0.8-6.0R/1329	Innco systems GmbH	Communication antenna	411068-0003	N/A
☐ -	FPA3-0.8-6.0R/1329	Innco systems GmbH	Communication antenna	411068-0001	N/A
■ -	DE3700-RH	Innco systems GmbH	Antenna master	N/A	N/A
☐-	SFI101	Rohde & Schwarz	Wlan RSE Switchimg Aad Filter Unlt	N/A	N/A
■ -	SCU03	Rohde & Schwarz	Signal Conditioning unit	100333	Feb. 19, 2020 (1Y)
■ -	SCU18	Rohde & Schwarz	Signal Conditioning unit	102266	Jul. 24, 2019 (1Y)
☐ -	SCU40A	Rohde & Schwarz	Signal Conditioning unit	N/A	Feb. 20, 2020 (1Y)
☐ -	HPF 3GHz	Rohde & Schwarz	High Pass Filter	N/A	Feb. 19, 2020 (1Y)
☐ -	HPF 1.5GHz	Rohde & Schwarz	High Pass Filter	N/A	Feb. 19, 2020 (1Y)
☐-	HPF 3GHz	Rohde & Schwarz	High Pass Filter	N/A	Feb. 19, 2020 (1Y)
☐ -	F1 GSM 850	Rohde & Schwarz	Filter	N/A	Feb. 19, 2020 (1Y)
☐ -	F2 GSM 900	Rohde & Schwarz	Filter	N/A	Feb. 19, 2020 (1Y)
☐ -	F3 GSM 1800	Rohde & Schwarz	Filter	N/A	Feb. 19, 2020 (1Y)
☐ -	F4 GSM 1900	Rohde & Schwarz	Filter	N/A	Feb. 19, 2020 (1Y)
☐ -	F5 CDMA CELL	Rohde & Schwarz	Filter	N/A	Feb. 19, 2020 (1Y)
☐ -	F6 CDMA PCS	Rohde & Schwarz	Filter	N/A	Feb. 19, 2020 (1Y)

All test equipment used is calibrated on a regular basis.

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5.5 Test data (Below 1 GHz)

-. Test Date : May 21, 2020 ~ May 25, 2020

-. Resolution bandwidth : 100 kHz

-. Frequency range : 30 MHz ~ 1 GHz

-. Operating condition : Highest Output Power Transmitting Mode

-. Measurement distance : 3 m

Frequency (MHz)	Level (dBm)	Pol	Limit (dBm)	Margin (dB)
Low Channel				
Measurements are 6 dB below these limits, the measurements are not reported.				
High Channel				
Measurements are 6 dB below these limits, the measurements are not reported.				

Remark: “H”: Horizontal, “V”: Vertical

5.6 Test data (Above 1 GHz)

-. Test Date : May 21, 2020 ~ May 25, 2020

-. Resolution bandwidth : 1 MHz

-. Frequency range : 1 GHz ~ 6 GHz

-. Operating condition : Highest Output Power Transmitting Mode

-. Measurement distance : 3 m

Frequency (MHz)	Level (dBm)	Pol	Limit (dBm)	Margin (dB)
Low Channel				
Measurements are 6 dB below these limits, the measurements are not reported.				
High Channel				
Measurements are 6 dB below these limits, the measurements are not reported.				

Remark: “H”: Horizontal, “V”: Vertical

Tested by: Hyung-Kwon, Oh / Assistant Manager

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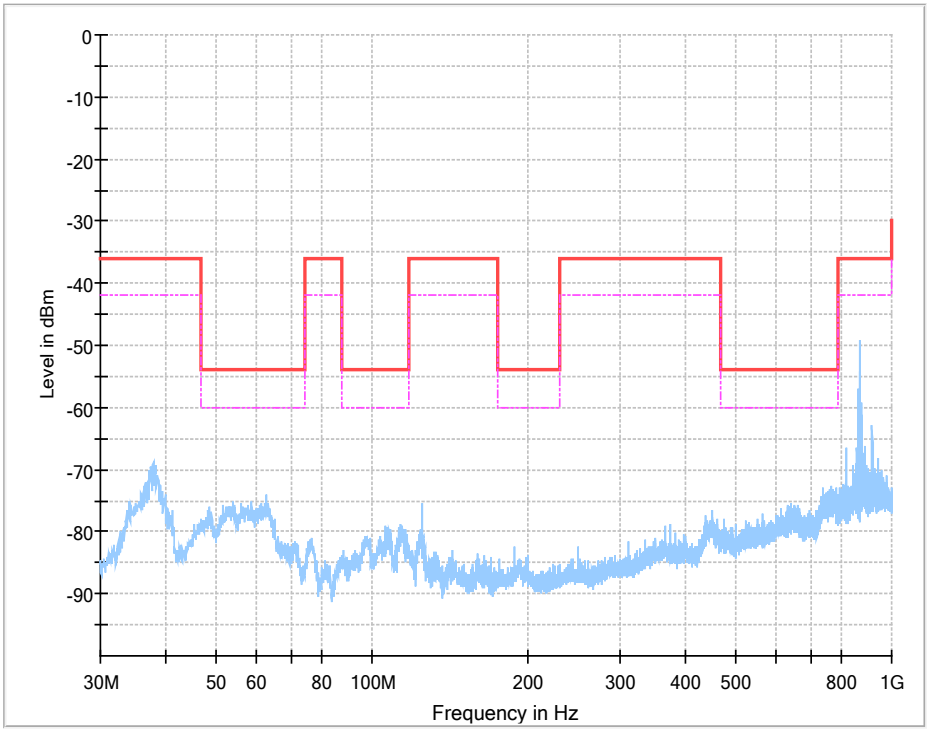
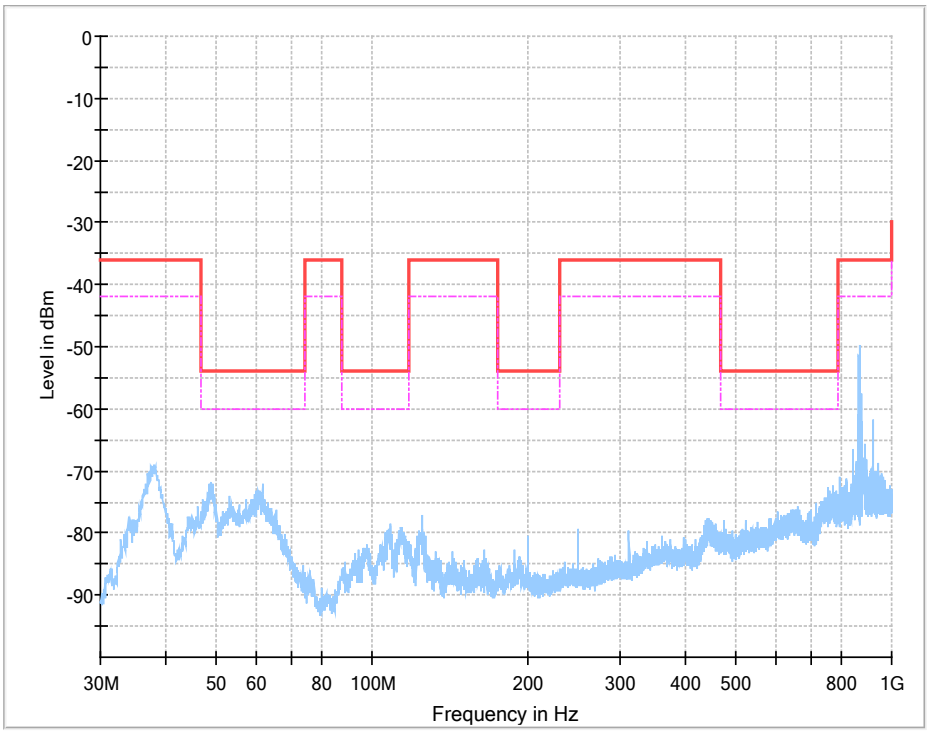
5.7 Plots of measurement data



Low Channel - Transmitting Mode(Below 1 GHz)



High channel - Transmitting Mode(Below 1 GHz)

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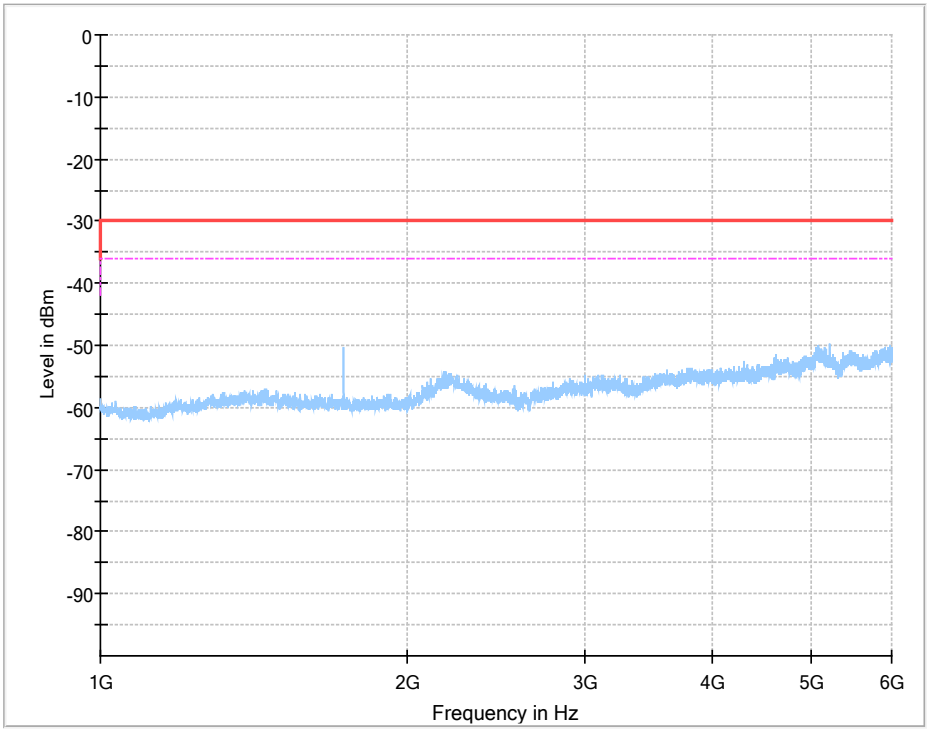
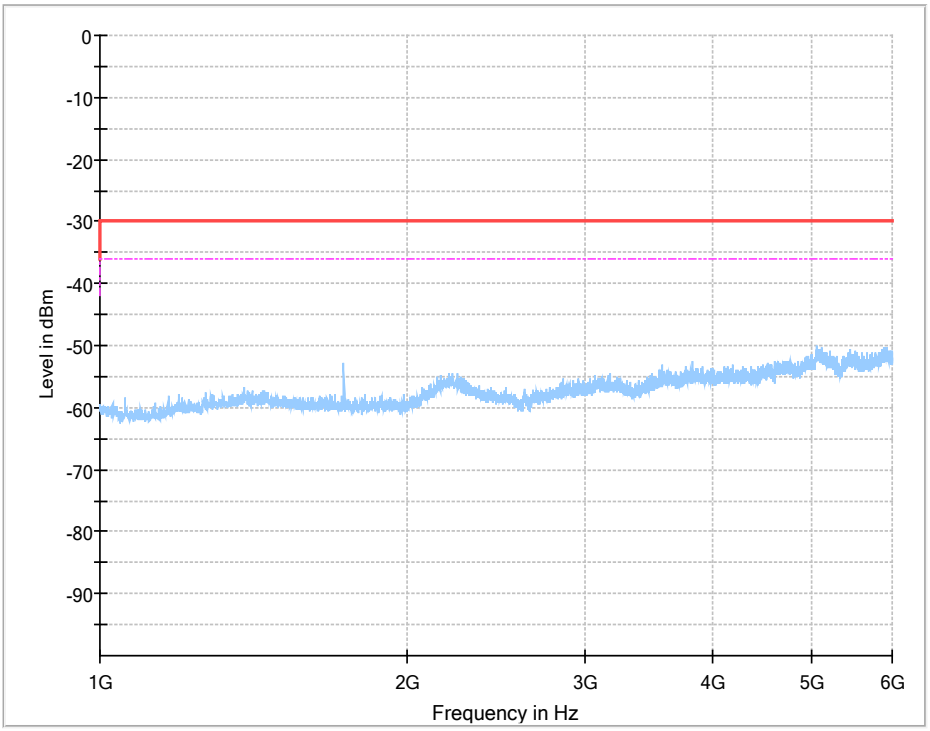


Low Channel - Transmitting Mode(Above 1 GHz)



High channel - Transmitting Mode(Above 1 GHz)

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5.8 Limit

Subclause: 5.9.2 of ETSI EN 300 220-1 V3.1.1

Frequency / State	47 MHz to 74 MHz 87,5 MHz to 118 MHz 174 MHz to 230 MHz 470 MHz to 790 MHz	Other frequencies below 1 000 MHz	Frequencies above 1 000 MHz
TX mode	-54 dBm	-36 dBm	-30 dBm
RX and all other modes	-57 dBm	-57 dBm	-47 dBm

Tested by: Hyung-Kwon, Oh / Assistant Manager

6. RECEIVR SPURIOUS EMISSION

6.1 Operating environment

Temperature : 24 °C

Relative humidity : 49 % R.H.

6.2 Test set-up

EN 300 220-1 V3.1.1 Clauses 5.9.3.3.2

6.3 Measurement uncertainty

Radiated emission electric field intensity, 30 MHz ~ 300 MHz : ± 4.1 dB

Radiated emission electric field intensity, 300 MHz ~ 1 000 MHz : ± 3.5 dB

Radiated emission electric field intensity, 1 GHz ~ 18 GHz : ± 4.2 dB

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6.4 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal.(Interval)
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■	- OSP120	Rohde & Schwarz	Open Switch and Control Unit	101364	N/A
■	- OSP150	Rohde & Schwarz	Open Switch and Control Unit	100871	N/A
■	- Controller CO 2000	Innco systems GmbH	Digital Controller	N/A	N/A
■	- VULB9163	Schwarzbeck	TRILOG Broadband Antenna	777	Apr. 08, 2020 (2Y)
☐	- DT3000	Innco System	Turn Table	930611	N/A
■	- BBHA 9120D	Schwarzbeck	Horn Antenna	9120D-1366	Jul. 16, 2019 (1Y)
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☐	- QMS-00208	Schwarzbeck	Horn Antenna	16111	Nov. 25, 2019 (1Y)
■	- MA 2000	Innco systems GmbH	Antenna master	N/A	N/A
■	- AS1700-EP	Innco systems GmbH	Antenna master	N/A	N/A
■	- DS 1200 S	Innco systems GmbH	Turn table	N/A	N/A
☐	- FPA3-0.8-6.0R/1329	Innco systems GmbH	Communication antenna	411068-0003	N/A
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☐	- SFI101	Rohde & Schwarz	Wlan RSE Switchimg Aad Filter Unlt	N/A	N/A
■	- SCU03	Rohde & Schwarz	Signal Conditioning unit	100333	Feb. 19, 2020 (1Y)
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☐	- F1 GSM 850	Rohde & Schwarz	Filter	N/A	Feb. 19, 2020 (1Y)
☐	- F2 GSM 900	Rohde & Schwarz	Filter	N/A	Feb. 19, 2020 (1Y)
☐	- F3 GSM 1800	Rohde & Schwarz	Filter	N/A	Feb. 19, 2020 (1Y)
☐	- F4 GSM 1900	Rohde & Schwarz	Filter	N/A	Feb. 19, 2020 (1Y)
☐	- F5 CDMA CELL	Rohde & Schwarz	Filter	N/A	Feb. 19, 2020 (1Y)
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6.5 Test data (Below 1 GHz)

-. Test Date : May 21, 2020 ~ May 25, 2020

-. Resolution bandwidth : 100 kHz

-. Frequency range : 30 MHz ~ 1 GHz

-. Operating condition : Receiving Mode

-. Measurement distance : 3 m

Frequency (MHz)	Level (dBm)	Pol	Limit (dBm)	Margin (dB)
Low Channel				
Measurements are 6 dB below these limits, the measurements are not reported.				
High Channel				
Measurements are 6 dB below these limits, the measurements are not reported.				

Remark: “H”: Horizontal, “V”: Vertical

6.6 Test data (Above 1 GHz)

-. Test Date : May 21, 2020 ~ May 25, 2020

-. Resolution bandwidth : 1 MHz

-. Frequency range : 1 GHz ~ 6 GHz

-. Operating condition : Receiving Mode

-. Measurement distance : 3 m

Frequency (MHz)	Level (dBm)	Pol	Limit (dBm)	Margin (dB)
Low Channel				
Measurements are 6 dB below these limits, the measurements are not reported.				
High Channel				
Measurements are 6 dB below these limits, the measurements are not reported.				

Remark: “H”: Horizontal, “V”: Vertical

Tested by: Hyung-Kwon, Oh / Assistant Manager

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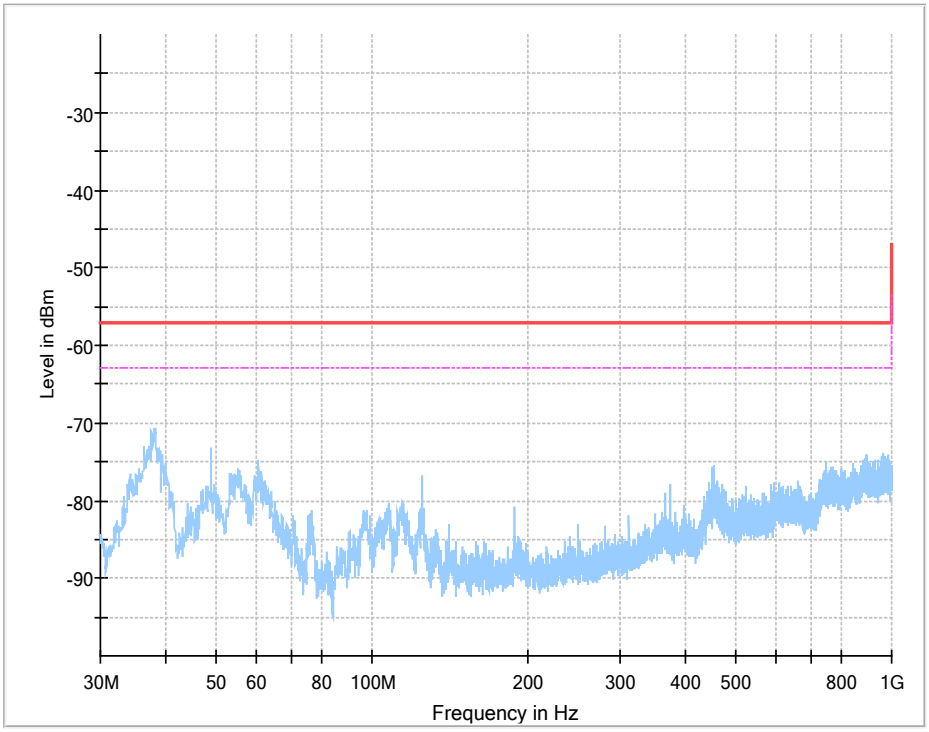
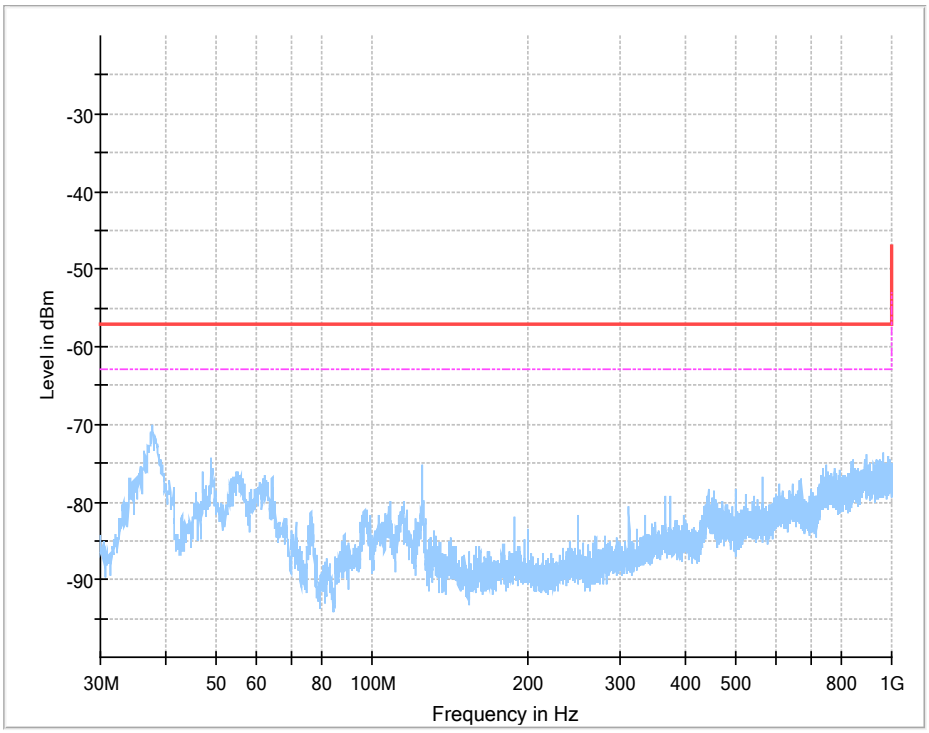
6.7 Plots of measurement data



Low Channel - Receiving Mode (Below 1 GHz)



High channel - Receiving Mode (Below 1 GHz)

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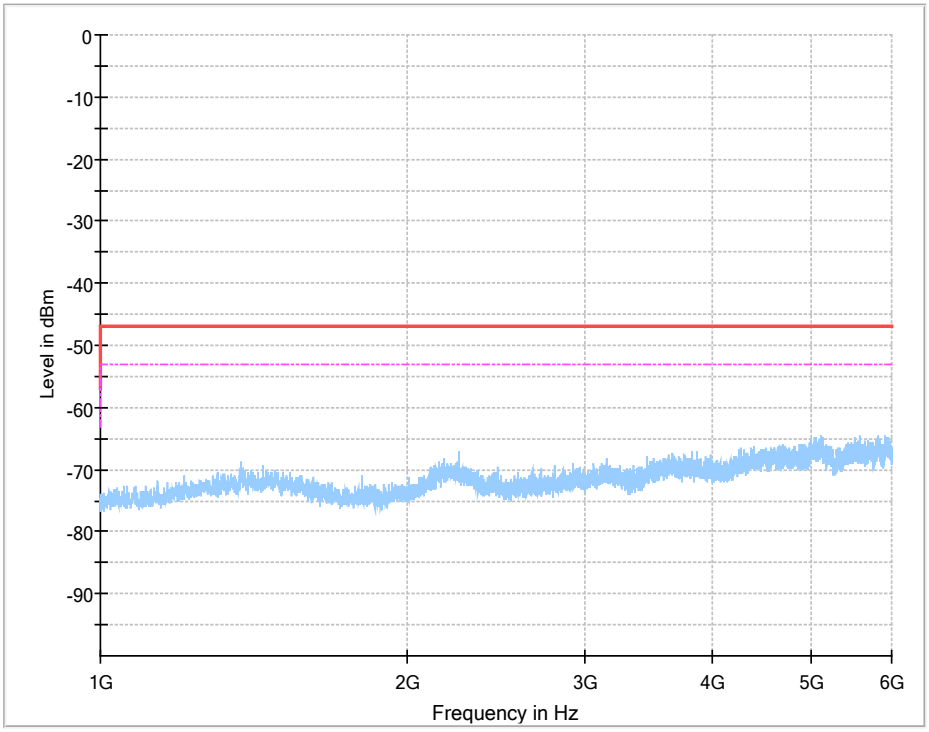
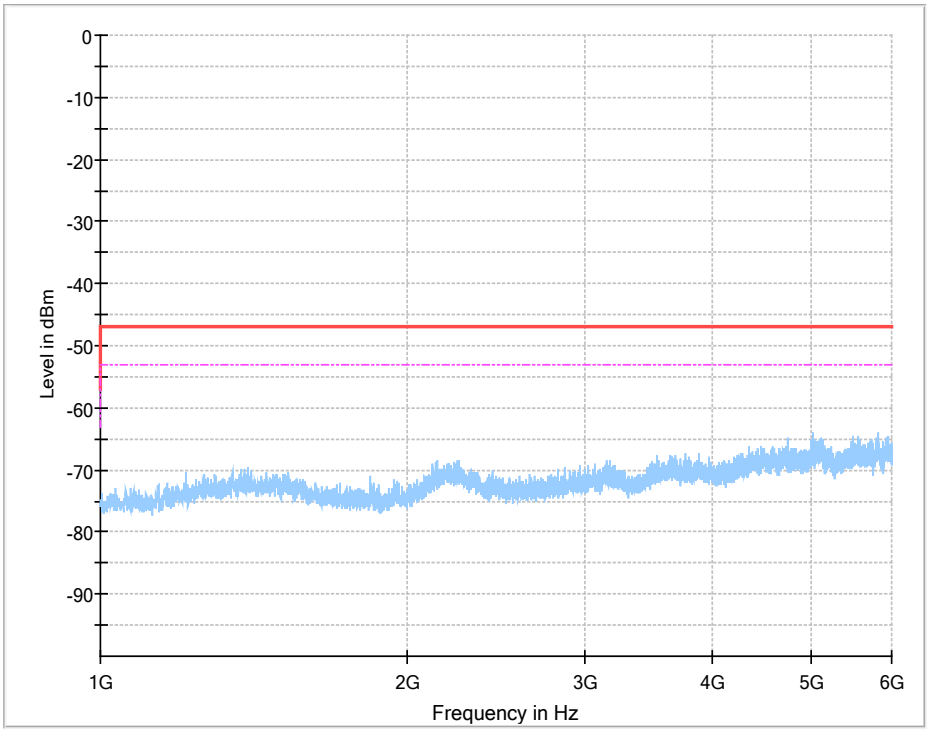


Low Channel - Receiving Mode (Above 1 GHz)



High channel - Receiving Mode (Above 1 GHz)

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6.8 Limit

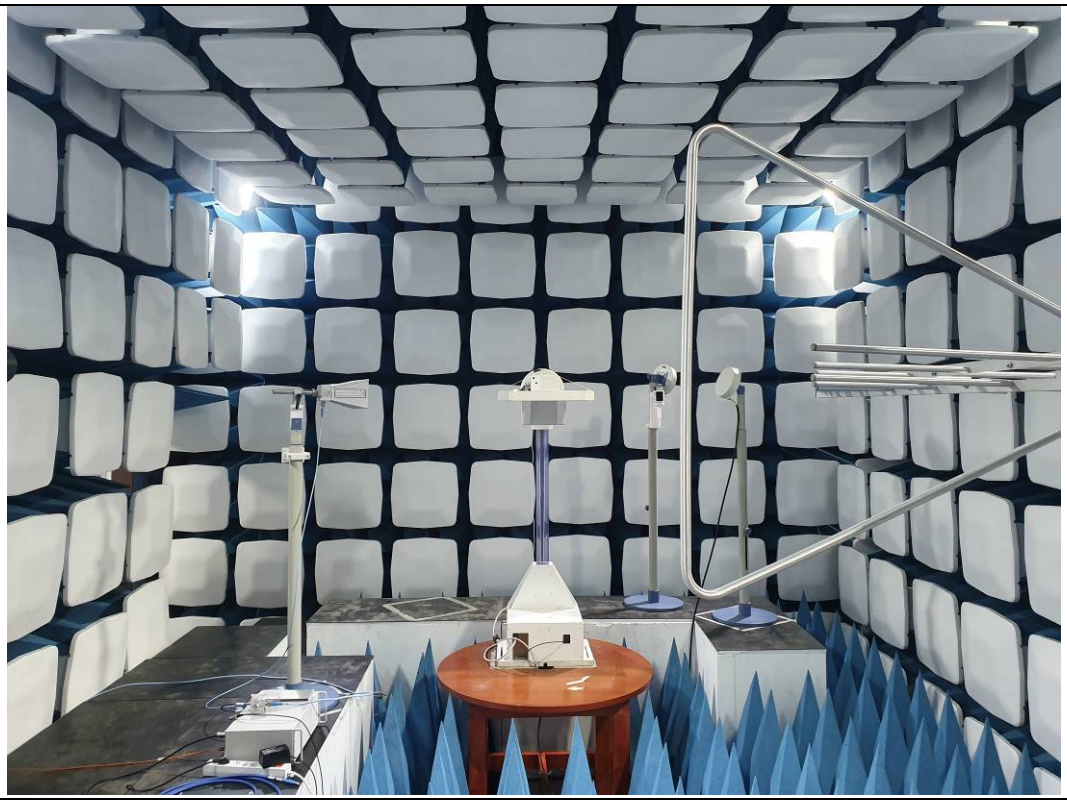
Subclause: 5.9.2 in EN 300 220-1 V3.1.1

Table 19: Spurious domain emission limits

Frequency / State	47 MHz to 74 MHz 87,5 MHz to 118 MHz 174 MHz to 230 MHz 470 MHz to 790 MHz	Other frequencies below 1 000 MHz	Frequencies above 1 000 MHz
TX mode	-54 dBm	-36 dBm	-30 dBm
RX and all other modes	-57 dBm	-57 dBm	-47 dBm

Tested by: Hyung-Kwon, Oh / Assistant Manager

APPENDIX I - TEST SET-UP PHOTO



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