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Project No.: 12CA08535
File No.: MC16340
Report No.: 12CA08535-2-FCC
Date: August 17, 2013
Model No.: FXRS-03A
FCC ID.: RYK-WPEA121N
IC Number: 6158A-WPEA121NW

RF Test Report

in accordance with
FCC Part 15 Subpart E §15.407 and IC RSS-210 Issue 8

for

System Control Unit

Vieworks Co., Ltd
#601 ~ 610, Suntechcity 2, 307-2, Sangdaewon-dong Jungwon-Gu Seongnam-city Gyeonggi-do, 462-806, South korea

Summary of Test Results:

The following tests were performed on a sample submitted for evaluation of compliance with FCC Part 15 C Section 15.247 and IC RSS-210 Issue 8.

No	Reference Clause No.		FCC Part15 Subpart C Conformance Requirements	Result Verdict	Remark
	FCC Rule	IC Rule			
1	15.403(i)	A9.2	26dB & 99% Bandwidth Measurement	N/A	*Note [2]
2	15.407(a)	A9.2	Power Spectral Density Measurement	N/A	*Note [2]
3	-	-	Average Power Measurement	-	-
4	15.407(a)	A9.2	Output Power Measurement	N/A	*Note [2]
5	15.407(b)	A9.3	Conducted Spurious Emission Measurement	N/A	*Note [2]
6	15.407(b)	A9.3	Band Edges Measurement	N/A	*Note [2]
7	15.407(g)	A9.5	Frequency Stability Measurement	N/A	*Note [2]
8	15.207	Gen 7.2.2	AC Conducted Emission Measurement	Complied	-
9	15.407(c)	A9.5	Automatically Discontinue Transmission	N/A	*Note [2]
10	15.205(a)	-	Restricted bands of operation	Complied	-
11	15.209(a)	-	Radiated emission limits, general requirements	Complied	-

*Note [1]: N/T=Not Tested, N/A=Not Applicable

*Note [2]: Test was performed by modular transmitter (FCC ID: RYK-WPEA121N, Test Report no. FR131667AN issued on May.02,2011 by Sporton International Inc.)

Compliance with FCC rules is being demonstrated by performing radiated spurious emissions on the host system and providing the test reports for the rf module used in this system to cover the antenna port measurement requirements.

The modular reports allow for a maximum gain PIFA antenna to be 2.0dBi/2.0dBi in the 2.4GHz band and 5GHz bands. This host device uses a dipole antenna with a maximum gain of 3.585 dBi in the 2.4GHz band and 2.83dBi in the 5GHz bands, therefore the limits used for the output power and power spectral density in the modular reports for 5GHz operations (DTS and NII) show compliance for the host using these antennas as they are of equal or lower gain. For 2.4GHz operations the composite gain for 2x2 beamforming modes is 6.6 dBi. the output power limit for a 6.6 dBi antenna is 29.4dBm. the maximum measured output power was 27.19dBm which complies with this limit of 28.3dBm. All bandwidth, power and power density measurements were made in accordance with the latest FCC KDB guidance documents for DTS and NII transmitters.

Radiated spurious emissions were tested for the host system so the different antenna type is covered by the system level tests.

Conclusion:

The tests listed in the Summary of Testing section of this report have been performed and the results recorded by UL Korea Ltd. in accordance with the procedures stated in each test requirement and specification. The test list was determined by the Applicant as being applicable to the Equipment Under Test. As a result, the subject product has been verified to comply or not comply as noted in the Summary of Testing with each test specification. The test results relate only to the items tested.

Witness tested by
Hongsuk Oh, WiSE Associate Project Engineer
UL Verification Services- 3014ASEO
UL Korea Ltd.
Aug. 17, 2013

Reviewed by
Jeawoon, Choi, WiSE Operations Manager
UL Verification Services- 3014ASEO
UL Korea Ltd.
Aug. 17, 2013

Test Report Details

Test Report No:	12CA08535-2-FCC
Witness Tests Performed By:	UL Korea Ltd. 33rd FL. GFC Center, 737 Yeoksam-dong, Gangnam-gu, Seoul, 135-984, Korea
Test Site:	KES Co., Ltd. 477-6, Hageo-ri, Yeoju-eup, Yeoju-gun, Gyeonggi-do, 469-803, Korea
Applicant:	Vieworks Co., Ltd. #601 ~ 610, Suntechcity 2, 307-2, Sangdaewon-dong Jungwon-Gu Seongnam-city Gyeonggi-do, 462-806, South korea
Applicant Contact:	Jeong-mi Kim
Title:	Manager
Phone:	+82-70-7011-6176
Fax:	+82-31-737-4953
FCC ID:	RYK-WPEA121N
IC Number:	6158A-WPEA121NW
E-mail:	salangshy@vieworks.com
Product Type:	System Control Unit
Model Number:	FXRS-03A
Trademark	System Control Unit
Sample Serial Number:	N/A
Test standards:	FCC Part 15 C Section 15.407 and IC RSS-210 Issue 8
Sample Serial Number:	N / A
Sample Receive Date:	2013.07.09
Testing Date:	2013.07.30 ~ 2013.08.09
Test Report Date:	2013.08.17
Overall Results:	**Pass**

UL Korea Ltd. reports apply only to the specific test samples and test results submitted for UL's review. All samples tested were in good operating condition throughout the entire test program. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. UL Korea Ltd. shall have no liability for any deductions, inferences or generalizations drawn by the client or others from UL Korea Ltd. issued reports. This report shall not be used to claim, constitute or imply product certification, approval, or any agency of the National Authorities. This report may contain test results that are not covered by the NVLAP or KOLAS accreditation.

Report Directory

1. General Product Information

5.1. Equipment Description

Wireless communication is established between the ViVIX-S Wireless detector and System Control Unit.

5.2. Details of Test Equipment (EUT)

- Equipment Type : System Control Unit
- Model No. : FXRS-03A
- Trade name : System Control Unit
- Type of test Equipment : System Control Unit
- Operating characteristic : Short range wireless device operating in the 2400 – 2483.5 ISM frequency band
- Manufacturer : Vieworks Co., Ltd.
  #601 ~ 610, Suntechcity 2, 307-2, Sangdaewon-dong Jungwon GuSeongnam-city
  Gyeonggi-do, 462-806, South korea

5.3. Equipment Configuration

The EUT is consisted of the following component provided by the manufacturer.

Use*	Product Type	Manufacturer	Model	Comments
EUT	System Control Unit	Vieworks Co., Ltd.	FXRS-03A	-
***Note:** Use = EUT - Equipment Under Test, AE - Auxiliary/Associated Equipment. SIM - Simulator (Not Subjected to Test)				

5.4. Technical Data

Item	System Control Unit
Frequency Ranges	5180 ~ 5240 MHz, 5190 ~ 5230 MHz, 5745~5825 MHz, 5755 ~ 5795 MHz
Kind of modulation (s)	OFDM, BPSK, QPSK, 16QAM, 64QAM
Channel	5180 ~ 5240 MHz: 4 channel (11a/n_HT20– Non DFS) 5190 ~ 5230 MHz: 2 channel (11n_HT40– Non DFS) 5745~5825 MHz: 5 channel (11a/n_HT20– Non DFS) 5755 ~ 5795 MHz: 2 channel (11n_HT40 – Non DFS)
Antenna information	Connector type (Dipole antenna)
Working temperature	-20 ~ 70 ℃
***Note:** All the technical data described above were provided by the manufacturer.	

5.5. Antenna Information

Item	System Control Unit
Antenna Model Name	JK-450B
Antenna Type	Connector type
Manufacturer	RODEM MICROSYSTEM CO., LTD.
Transmit Gain dBi	2.4 G: Max. 3.585dBi, 5 G: Max. 2.830dBi
Azimuth Beam Pattern	Linear vertical
***Note:** All the technical data described above were provided by the manufacturer.	

5.6. Equipment Type :

☒ Radio and ancillary equipment for fixed or semi-fixed use
☐ Radio and ancillary equipment for vehicular mounted use
☐ Radio and ancillary equipment for portable or handheld use

☒ Stand alone ☐ Host connected

☐ Self contained single unit ☒ Module with associated connection or interface

5.7. Technical descriptions and documents

No.	Document Title and Description
1	User Manual
2	RODEM MICROSYSTEM CO., LTD. // Antenna specification // JK-450B
***Note:** The following document was provided by the manufacturer.	

5.8. Equipment Marking Plate

5.9. Description of additional model name

Model name	Model name Designation	Description of design
N/A	N/A	N/A

2. Test Specification

The following test specifications and standards have been applied and used for testing.

1) FCC Part 15 C Section 15.407

2) ANSI C63.4:2009
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

3) KDB 789033 D01 UNII General Test Procedures v01r03
Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices Part 15, Subpart E

3. Test Conditions

5.10. Equipment Used During Test

Use*	Product Type	Manufacturer	Model	Comments
EUT	System Control Unit	Vieworks Co., Ltd.	FXRS-03A	-
AE	X-Ray Detector	Vieworks	FXRD-1417WA	-
AE	Note PC	Lenovo	X2000	-
***Note:** Use = EUT - Equipment Under Test, AE - Auxiliary/Associated Equipment. SIM - Simulator (Not Subjected to Test)				

5.11. Input/Output Ports

Port #	Name	Type*	Cable Max. >3m	Shielded	Comments
1	Mains	AC	1.6	Unshielded	SCU AC Power input port
2	Signal port	I/O	4.0 m	Shielded	Generator interface Cable
3	DC Output	DC	2.0 m	Shielded	SCU DC output port
4	RJ45	I/O	14.5 m	Shielded	PC - SCU interface Cable
5	Signal port	I/O	15 m	Shielded	SCU - X-Ray detector Cable

Note 1: All the interface cables and Power Cable have been provided by the manufacturer
Note 2: *AC = AC Power Port DC = DC Power Port N/E = Non-Electrical
I/O = Signal Input or Output Port (Not Involved in Process Control)
TP = Telecommunication Ports

5.12. Power Interface

Mode #	Voltage (V)	Current (A)	Power (W)	Frequency (DC/AC-Hz)	Comments
Rated	AC100 to 240V	-	-	50/60 Hz	Rated of System Control Unit
1	120V	-	-	60Hz	-

5.13. Operating Frequencies

Mode #	Frequency tested
1	Operating frequency range : 5 180 MHz ~ 5 240 MHz (11a & 11n_HT20) 3 channels in the Transmitter modes of 11b/g/n-HT20 are tested. - Low : 5 180 MHz / CH = 36 - Mid : 5 220 MHz / CH = 44 - Top : 5 240 MHz / CH= 48
2	Operating frequency range : 5 190 MHz ~ 5 230 MHz (11n_HT40) 3 channels in the Transmitter modes of 11n-HT40 are tested. - Low : 5 190 MHz / CH = 38 - Top : 5 230 MHz / CH= 46

5.14. Operation Modes

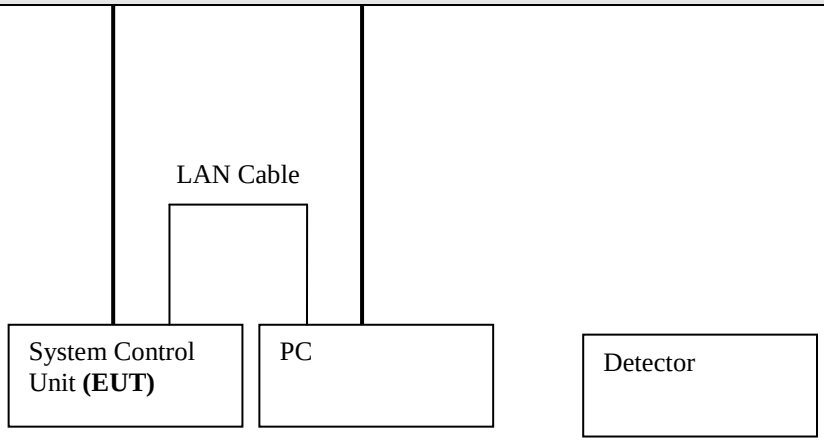
Mode #	Description
1	Carrier on mode: Signal from the RF module was generated continuously for the representative channels (Low, Mid, High) by the test program incorporated
2	Carrier off (Idle) mode: RF carrier was not activated by the RF module.

***Note:**

1. The worst-case condition is determined by the baseline measurement of rf output power of the modular transmitter test report. The worst-case channel was determined as the channel with highest output power.

2. Output power from the device during the radiated spurious measurements are within expected tolerance of the module test results to justify using the original conducted antenna port measurements for the module(average power).
   -. 11a : 12.0 dBm, 11an-HT20 : 14.0 dBm, 11an-HT40: 15.0 dBm for each channel
   -. 11a/n-HT20/40 : 16.0 dBm for each channel.

5.15. Test Configurations

No.	Test Set-up
1	

5.16. List of Test Equipment

No	Description	Manufacturer	Model	Identifier	Cal. Due
1	Spectrum Analyzer	R&S	FSV30	100736	2014.01.10
2	8360B Series Swept Signal Generator	HP	83630B	3844A00786	2014.06.06
3	Low Pass Filter	Mini-Circuits	NLP-1200+	V8979400903-1	2014.07.11
4	High Pass Filter	Wainwright Instrument	WHK6.0/18G-10SS	11	2014.07.07
5	High Pass Filter	Wainwright Instrument	WHJS3000-10TT	1	2014.01.10
6	Trilog-BroadBand Antenna	Schwarzbeck	VULB 9168	9168-462	2014.10.25
7	Horn Antenna	A.H.	SAS-571	414	2014.03.22
8	Preamplifier	R&S	SCU18	0117	2014.01.12

4. Overview of Technical requirements

The following essential requirements and test specifications are relevant to the presumption of conformity FCC Part 15 C Section 15.407			
Reference Clause No.	Essential technical requirements	Test method	Reported
15.205(a)	Restricted bands of operation	Note 1	[X]
15.209(a)	Radiated emission limits, general requirements		[X]
15.207	Transmitter AC power line conducted emission		[X]
15.203	Antenna Requirement		[X]

Note 1: The measurement procedures described in the American National Standard for Methods of Measurement of Radio-Noise Emission from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 MHz (ANSI C63.4-2009), the guidance provided in KDB 558074 and KDB 662911 D01 v02r01/D02 v01were used in the measurement of the DUT.

Note 2: This device use already certified module so that the below specified test items are not tested in the end product evaluation. (TX Module FCC ID : RYK-WPEA121N, Test Report no. FR131667AN issued on May.02,2011 by Sporton International Inc.)
-. 26dB bandwidth
-. Tx Output Power
-. Band edge
-. Tx Spectral Power Density
-. Conducted Spurious Emission
-. Peak Excursion Ratio
-. Frequency Stability
-. Discontinuous Transmission

5.17. Antenna Requirement

4.1.1. Standard Applicable

For intentional device, according to FCC 47 CFR Section §15.203, 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. And according to FCC 47 CFR Section § 15.247 (b), if transmitting antennas of directional gain greater than 6 dBi are used, the power shall be reduced by the amount in Db that the gain of the antenna exceeds 6 dBi.

4.1.2. Antenna Connected Construction

The antenna used of this product is dipole Antenna Assembly and peak max gain of each antennas as below. Antenna is permanently installed in the end product enclosure and no user exchange is allowed.

Band	2412 – 2462 MHz	5745 – 5825 MHz 5180 – 5320 MHz 5500 – 5700 MHz
Antenna Gain (dBi)	3.585dBi Max.	2.830dBi Max.

5. Test Results

5.1. Transmitter radiated spurious emissions

TEST: Transmitter radiated spurious emissions		
Method	Radiated emissions from the EUT were measured according to ANSI C63.4-2009 procedure. 1. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter anechoic chamber test site. The table was rotated 360 degrees to determine the position of the highest radiation. The antenna is is varied from 1 to 4 meters above the ground to find the maximum field strength. Measurement are made with both horizontal and vertical polarizations For dundamental investigation, the EUT was positioned for 3 orthogonal orientations. 2. For measurement below 1GHz, the resolution bandwidth is set to 100 kHz for peak detection or 120kHz for quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak. 3. For measurement above 1GHz, the resolution bandwidth is set to 1 MHz and video bandwidth is set to 1 MHz for peak measurement and 10 Hz for average measurement. 4. For 2.4GHz transmitter measurement, the spectrum from 30 MHz to 26GHz is investigated for Low, Mid and High channels. For 5 GHz transmitter measurement, the spectrum from 30 MHz to 40GHz is investigated for Low, Mid and High channels.	
Supplementary information: Radiated emission which fall in the restricted bands must also comply with FCC section 15.209.		
Reference Clause	Part15 C Section 15.407 (b)	
Parameters recorded during the test	Laboratory Ambient Temperature	22 ℃
	Relative Humidity	36 %
	Frequency range	Measurement Point
Fully configured sample scanned over the following frequency range	30MHz to 10th harmonics	Enclosure Port

Configuration Settings

Test Item	Power Interface Mode # (See Section 3.3)	Test Configurations Mode # (See Section 3.6)	EUT Operation Mode # (See 3.5)
Radiated Spurious emission	1	1	1
Conducted Spurious emission	1	1	1
Supplementary information: None			

Limits

For transmitters operating in the 5.15 ~ 5.25 GHz band: all emissions outside of the 5.15 ~ 5.35 GHz band shall not exceed an EIRP of -27 dBm/MHz.

For transmitters operating in the 5.25 ~ 5.35 GHz band: all emissions outside of the 5.15 ~ 5.35 GHz band shall not exceed an EIRP of -27 dBm/MHz.

Devices operating in the 5.25 ~ 5.35 GHz band that generate emissions in the 5.15 ~ 5.25 GHz band must meet all applicable technical requirements for operation in the 5.15 ~ 5.25 GHz band (including indoor use) or alternatively meet an out-of-band emission EIRP limit of -27 dBm/MHz in the 5.15 ~ 5.25 GHz band.

For transmitters operating in the 5.47 ~ 5.725 GHz band: all emissions outside of the 5.47 ~ 5.725 GHz band shall not exceed an EIRP of -27 dBm/MHz.

According to § 15.209(a), Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Distance (meters)	Field Strength (dBuV/m)	Field Strength (uV/m)
30-88	3	40.0	100
88-216	3	43.5	150
216-960	3	46.0	200
Above 960	3	54.0	500

5.1.1. Radiated Spurious Emissions for Below 1 GHz

Measurement method : ☒ Radiated ☐ Conducted
Mode of operation : Continuous Wave
Power setting : Max. Power condition declared by the manufacturer
Worst case configuration : 5GHz_HT40

Table 1. Test data for Radiated emission for Below 1 GHz

Radiated emissions			Ant	Correction factors			Total	Limit	
Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	Distance (dB)	AF (dB/m)	Amp gain+CL (dB)	Actual (dBuV/m)	Limit (dBuV/m)	Margin (dB)
129.5	22.88	Q.P.	V	N/A	11.92	2.15	36.95	43.50	6.55
145.8	20.56	Q.P.	V	N/A	12.86	2.33	35.75	43.50	7.75
159.9	19.77	Q.P.	H	N/A	13.31	2.47	35.55	43.50	7.95
160.1	20.98	Q.P.	V	N/A	13.30	2.47	36.75	43.50	6.75
750.0	13.56	Q.P.	H	N/A	21.61	6.08	41.25	46.00	4.75
750.0	17.26	Q.P.	V	N/A	21.61	6.08	44.95	46.00	1.05

Supplementary information:
-. The frequency spectrum from 30 MHz to 1 000 MHz was investigated. Emission levels are not reported much lower than the limits by over 30 dB. All reading values are peak values.

Remark
a. To get a maximum emission level from the EUT, the EUT was moved throughout the x-axis, Y-axis and Z-axis. The worst case is Y-axis.
b. Actual = Reading + AF + AMP + CL (AF : Antenna factor, AMP : Amp gain, CL : Cable loss)
c. Distance factor = 20log(Measurement distance / The measured distance)
d. Margin = Limit (dBuV/m) - Actual (dBuV/m)

5.1.2. Radiated Spurious Emissions for Above 1 GHz

Measurement method : ☒ Radiated ☐ Conducted
Mode of operation : Continuous Wave

802.11a_Non DFS (5 180 – 5 240 MHz)

Table 2. Low Channel (5 180 MHz)

Radiated emissions			Ant	Correction factors			Total	Limit	
Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	Distance (dB)	AF (dB/m)	Amp gain+CL (dB)	Actual (dBuV/m)	Limit (dBuV/m)	Margin (dB)
10360	49.32	Peak	H	N/A	37.58	-33.70	53.20	74.00	20.80
10360	40.05	Average	H	N/A	37.58	-33.70	43.93	54.00	10.07
10360	49.98	Peak	V	N/A	37.58	-33.70	53.86	74.00	20.14
10360	42.25	Average	V	N/A	37.58	-33.70	46.13	54.00	7.87

Table 3. Middle Channel (5 220 MHz)

Radiated emissions			Ant	Correction factors			Total	Limit	
Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	Distance (dB)	AF (dB/m)	Amp gain+CL (dB)	Actual (dBuV/m)	Limit (dBuV/m)	Margin (dB)
10440	48.27	Peak	H	N/A	37.67	-33.66	52.28	74.00	21.72
10440	43.38	Average	H	N/A	37.67	-33.66	47.39	54.00	6.61
10440	47.82	Peak	V	N/A	37.67	-33.66	51.83	74.00	22.17
10440	42.25	Average	V	N/A	37.67	-33.66	46.26	54.00	7.74

Table 4. High Channel (5 240 MHz)

Radiated emissions			Ant	Correction factors			Total	Limit	
Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	Distance (dB)	AF (dB/m)	Amp gain+CL (dB)	Actual (dBuV/m)	Limit (dBuV/m)	Margin (dB)
10480	47.77	Peak	H	N/A	37.61	-33.64	51.74	74.00	22.26
10480	36.77	Average	H	N/A	38.11	-33.64	41.24	54.00	12.76
10480	47.54	Peak	V	N/A	38.11	-33.64	52.01	74.00	21.99
10480	36.13	Average	V	N/A	38.11	-33.64	40.60	54.00	13.40

11n_HT20

Table 5. Low Channel (5 180 MHz)

Radiated emissions			Ant	Correction factors			Total	Limit	
Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	Distance (dB)	AF (dB/m)	Amp gain+CL (dB)	Actual (dBuV/m)	Limit (dBuV/m)	Margin (dB)
10360	50.68	Peak	H	N/A	37.58	-33.70	54.56	74.00	19.44
10360	39.00	Average	H	N/A	37.58	-33.70	42.88	54.00	11.12
10360	49.28	Peak	V	N/A	37.58	-33.70	53.16	74.00	20.84
10360	38.55	Average	V	N/A	37.58	-33.70	42.43	54.00	11.57

Table 6. Middle Channel (5 220 MHz)

Radiated emissions			Ant	Correction factors			Total	Limit	
Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	Distance (dB)	AF (dB/m)	Amp gain+CL (dB)	Actual (dBuV/m)	Limit (dBuV/m)	Margin (dB)
10440	48.73	Peak	H	N/A	37.67	-33.66	52.74	74.00	21.26
10440	38.57	Average	H	N/A	37.67	-33.66	42.58	54.00	11.42
10440	49.54	Peak	V	N/A	37.67	-33.66	53.55	74.00	20.45
10440	39.06	Average	V	N/A	37.67	-33.66	43.07	54.00	10.93

Table 7. High Channel (5 240 MHz)

Radiated emissions			Ant	Correction factors			Total	Limit	
Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	Distance (dB)	AF (dB/m)	Amp gain+CL (dB)	Actual (dBuV/m)	Limit (dBuV/m)	Margin (dB)
10480	47.75	Peak	H	N/A	37.61	-33.64	51.72	74.00	22.28
10480	36.96	Average	H	N/A	38.11	-33.64	41.43	54.00	12.57
10480	49.43	Peak	V	N/A	38.11	-33.64	53.90	74.00	20.10
10480	36.97	Average	V	N/A	38.11	-33.64	41.44	54.00	12.56

11n_HT40

Table 8. Low Channel (5 190 MHz)

Radiated emissions			Ant	Correction factors			Total	Limit	
Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	Distance (dB)	AF (dB/m)	Amp gain+CL (dB)	Actual (dBuV/m)	Limit (dBuV/m)	Margin (dB)
10380	50.96	Peak	H	N/A	37.55	-33.69	54.82	74.00	19.18
10380	44.97	Average	H	N/A	37.55	-33.69	48.83	54.00	5.17
10380	51.91	Peak	V	N/A	37.55	-33.69	55.77	74.00	18.23
10380	45.40	Average	V	N/A	37.55	-33.69	49.26	54.00	4.74

Table 9. High Channel (5 230 MHz)

Radiated emissions			Ant	Correction factors			Total	Limit	
Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	Distance (dB)	AF (dB/m)	Amp gain+CL (dB)	Actual (dBuV/m)	Limit (dBuV/m)	Margin (dB)
10460	48.59	Peak	H	N/A	38.16	-33.65	53.10	74.00	20.90
10460	36.39	Average	H	N/A	37.62	-33.65	40.36	54.00	13.64
10460	50.39	Peak	V	N/A	37.62	-33.65	54.36	74.00	19.64
10460	36.10	Average	V	N/A	37.62	-33.65	40.07	54.00	13.93

Supplementary information:

-. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental Frequency. Radiated emissions measured in frequency above 1 000 MHz were made with an instrument using peak/average detector mode.

Remark

1) Radiated emissions measured in frequency above 1 000 MHz were made with an instrument using Peak/average detector mode if frequency was in restricted band. Otherwise the frequency was in outside of restricted band, only peak detector should be used.
2) Average test would be performed if the peak result were greater than the average limit and frequency was in the restricted band.
3) To get a maximum emission level from the EUT, the EUT was moved throughout the x-axis, Y-axis and Z-axis. The worst case is Y -axis.
4) Actual = Reading + AF + AMP + CL (AF : Antenna factor, AMP : Amp gain, CL : Cable loss)
5) Distance factor = 20log(Measurement distance / The measured distance)
6) Margin = Limit (dBuV/m) - Actual (dBuV/m)
7) If frequency was outside of restricted band, the calculation method for peak limit is same as below: 68.23 dBuV/m = EIRP – 20 log(d) + 104.77 = -27 – 20 log (3) + 104.77
   *distance: 3 m, *EIRP: -27 dBm/MHz

5.1.3. Radiated Restricted Band Edge Measurements

Measurement method : ☒ Radiated ☐ Conducted
Mode of operation : Continuous Wave

Table 10. Measurement for restricted band of 11a – Non DFS

Radiated emissions			Ant	Correction factors			Total	Limit	
Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	Distance (dB)	AF (dB/m)	Cable loss (dB)	Actual (dBuV/m)	Limit (dBuV/m)	Margin (dB)
4825.00	17.77	Peak	V	-9.54	32.32	9.62	50.17	74.00	23.83
5145.70	13.36	Average	V	-9.54	33.42	9.10	46.34	54.00	7.66
4626.80	17.30	Peak	H	-9.54	31.73	8.93	48.42	74.00	25.58
4860.80	12.99	Average	H	-9.54	32.68	9.24	45.37	54.00	8.63

Table 11. Measurement for restricted band of 11n – Non DFS(5 GHz)

Radiated emissions			Ant	Correction factors			Total	Limit	
Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	Distance (dB)	AF (dB/m)	Cable loss (dB)	Actual (dBuV/m)	Limit (dBuV/m)	Margin (dB)
4709.10	17.95	Peak	V	-9.54	32.63	8.96	50.00	74.00	24.00
5150.00	13.02	Average	V	-9.54	33.43	9.06	45.97	54.00	8.03
5038.40	18.77	Peak	H	-9.54	33.35	9.07	51.65	74.00	22.35
5145.70	13.36	Average	H	-9.54	33.42	9.10	46.34	54.00	7.66

Table 12. Measurement for restricted band of 11n(HT20) – Non DFS(5 GHz)

Radiated emissions			Ant	Correction factors			Total	Limit	
Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	Distance (dB)	AF (dB/m)	Cable loss (dB)	Actual (dBuV/m)	Limit (dBuV/m)	Margin (dB)
4926.80	18.12	Peak	V	-9.54	33.13	9.41	51.12	74.00	22.88
4919.20	12.79	Average	V	-9.54	33.07	9.40	45.72	54.00	8.28
4793.60	19.15	Peak	H	-9.54	32.25	8.90	50.76	74.00	23.24
4723.20	12.20	Average	H	-9.54	32.71	9.14	44.51	54.00	9.49

Remark

1) Radiated emissions measured in frequency above 1 000 MHz were made with an instrument using Peak/average detector mode if frequency was in restricted band. Otherwise the frequency was in outside of restricted band, only peak detector should be used.
2) Average test would be performed if the peak result were greater than the average limit and frequency was in the restricted band.
3) To get a maximum emission level from the EUT, the EUT was moved throughout the x-axis, Y-axis and Z-axis. The worst case is Y -axis.
4) Actual = Reading + AF + AMP + CL (AF : Antenna factor, AMP : Amp gain, CL : Cable loss)
5) Distance factor = 20log(Measurement distance / The measured distance)
6) Margin = Limit (dBuV/m) - Actual (dBuV/m)
7) If frequency was outside of restricted band, the calculation method for peak limit is same as below: 68.23 dBuV/m = EIRP – 20 log(d) + 104.77 = -27 – 20 log (3) + 104.77
   *distance: 3 m, *EIRP: -27 dBm/MHz

5.1.4. Receiving mode Radiated Spurious Emissions for Above 1 GHz

Measurement method : ☒ Radiated ☐ Conducted
Mode of operation : Receiving mode

802.11a_Non DFS (5 180 – 5 240 MHz)

Table 13. Low Channel (5 180 MHz)

Frequency [MHz]	Reading [dBuV/m] AV / Peak	Pol.	Correction Factor [dB]		Limits [dBuV/m] AV / Peak	Result [dBuV/m] AV / Peak	Margin [dB] AV / Peak
			Ant	CL+Amp			
No emissions were detected at a level greater than 20dB below limit.							

Table 14. Middle Channel (5 220 MHz)

Frequency [MHz]	Reading [dBuV/m] AV / Peak	Pol.	Correction Factor [dB]		Limits [dBuV/m] AV / Peak	Result [dBuV/m] AV / Peak	Margin [dB] AV / Peak
			Ant	CL+Amp			
No emissions were detected at a level greater than 20dB below limit.							

Table 15. High Channel (5 240 MHz)

Frequency [MHz]	Reading [dBuV/m] AV / Peak	Pol.	Correction Factor [dB]		Limits [dBuV/m] AV / Peak	Result [dBuV/m] AV / Peak	Margin [dB] AV / Peak
			Ant	CL+Amp			
No emissions were detected at a level greater than 20dB below limit.							

11n_HT20

Table 16. Low Channel (5 180 MHz)

Frequency [MHz]	Reading [dBuV/m] AV / Peak	Pol.	Correction Factor [dB]		Limits [dBuV/m] AV / Peak	Result [dBuV/m] AV / Peak	Margin [dB] AV / Peak
			Ant	CL+Amp			
No emissions were detected at a level greater than 20dB below limit.							

Table 17. Middle Channel (5 220 MHz)

Frequency [MHz]	Reading [dBuV/m] AV / Peak	Pol.	Correction Factor [dB]		Limits [dBuV/m] AV / Peak	Result [dBuV/m] AV / Peak	Margin [dB] AV / Peak
			Ant	CL+Amp			
No emissions were detected at a level greater than 20dB below limit.							

Table 18. High Channel (5 240 MHz)

Frequency [MHz]	Reading [dBuV/m] AV / Peak	Pol.	Correction Factor [dB]		Limits [dBuV/m] AV / Peak	Result [dBuV/m] AV / Peak	Margin [dB] AV / Peak
			Ant	CL+Amp			
No emissions were detected at a level greater than 20dB below limit.							

11n_HT40

Table 19. Low Channel (5 190 MHz)

Frequency [MHz]	Reading [dBuV/m] AV / Peak	Pol.	Correction Factor [dB]		Limits [dBuV/m] AV / Peak	Result [dBuV/m] AV / Peak	Margin [dB] AV / Peak
			Ant	CL+Amp			
No emissions were detected at a level greater than 20dB below limit.							

Table 20. High Channel (5 230 MHz)

Frequency [MHz]	Reading [dBuV/m] AV / Peak	Pol.	Correction Factor [dB]		Limits [dBuV/m] AV / Peak	Result [dBuV/m] AV / Peak	Margin [dB] AV / Peak
			Ant	CL+Amp			
No emissions were detected at a level greater than 20dB below limit.							

Supplementary information:

-. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental Frequency. Radiated emissions measured in frequency above 1 000 MHz were made with an instrument using peak/average detector mode.

Remark

8) Radiated emissions measured in frequency above 1 000 MHz were made with an instrument using Peak/average detector mode if frequency was in restricted band. Otherwise the frequency was in outside of restricted band, only peak detector should be used.
9) Average test would be performed if the peak result were greater than the average limit and frequency was in the restricted band.
10) To get a maximum emission level from the EUT, the EUT was moved throughout the x-axis, Y-axis and Z-axis. The worst case is Y -axis.
11) Actual = Reading + AF + AMP + CL (AF : Antenna factor, AMP : Amp gain, CL : Cable loss)
12) Distance factor = 20log(Measurement distance / The measured distance)
13) Margin = Limit (dBuV/m) - Actual (dBuV/m)
14) If frequency was outside of restricted band, the calculation method for peak limit is same as below: 68.23 dBuV/m = EIRP – 20 log(d) + 104.77 = -27 – 20 log (3) + 104.77
*distance: 3 m, *EIRP: -27 dBm/MHz

5.2. Mains Terminal Disturbance Voltage Test

TEST: Limits of mains terminal disturbance voltage					
Method	Measurements were made on a ground plane that extends 1-meter minimum beyond all sides of the system under test. All power was connected to the system through Artificial Mains Network (AMN). Conducted voltage measurements on mains lines were made at the output of the AMN.				
Parameters recorded during the test		Laboratory Ambient Temperature	21℃		
		Relative Humidity	44%		
-		Frequency range on each side of line	Measurement Point		
Fully configured sample scanned over the following frequency range		0.15 MHz to 30 MHz	AC input port of EUT		
Limits - Class B					
Frequency (MHz)	Limit (dBµV)				
	Quasi-Peak	Result	Average	Result	
0.15 to 0.50	66 to 56	Pass	56 to 46	Pass	
0.50 to 5	56	Pass	46	Pass	
5 to 30	60	Pass	50	Pass	
EUT Configuration Settings:					
Power Interface Mode # (See Section 2.3)		EUT Operation Mode # (See 2.4)		EUT Configurations Mode # (See Section 2.5)	
1		1		1	
Conducted Emissions Test Equipment used:					
Description	Manufacturer	Model	Identifier	Cal. Due	
EMI Test Receiver	R&S	ESCI	100364	2014. 02. 27	
ANM(EUT)	R&S	ESH2-Z5	828739/006	2013. 09. 18	
LISN(Ancillary)	TTI	LISN1600	197204	2014.06. 27	
DC block	HYUPLIP	KFL-007	7-1581-5	N/A	
50 Ohm terminator	TME	CT-01	N/A	2013. 09. 01	

Figure.1. Conducted Emissions Graph

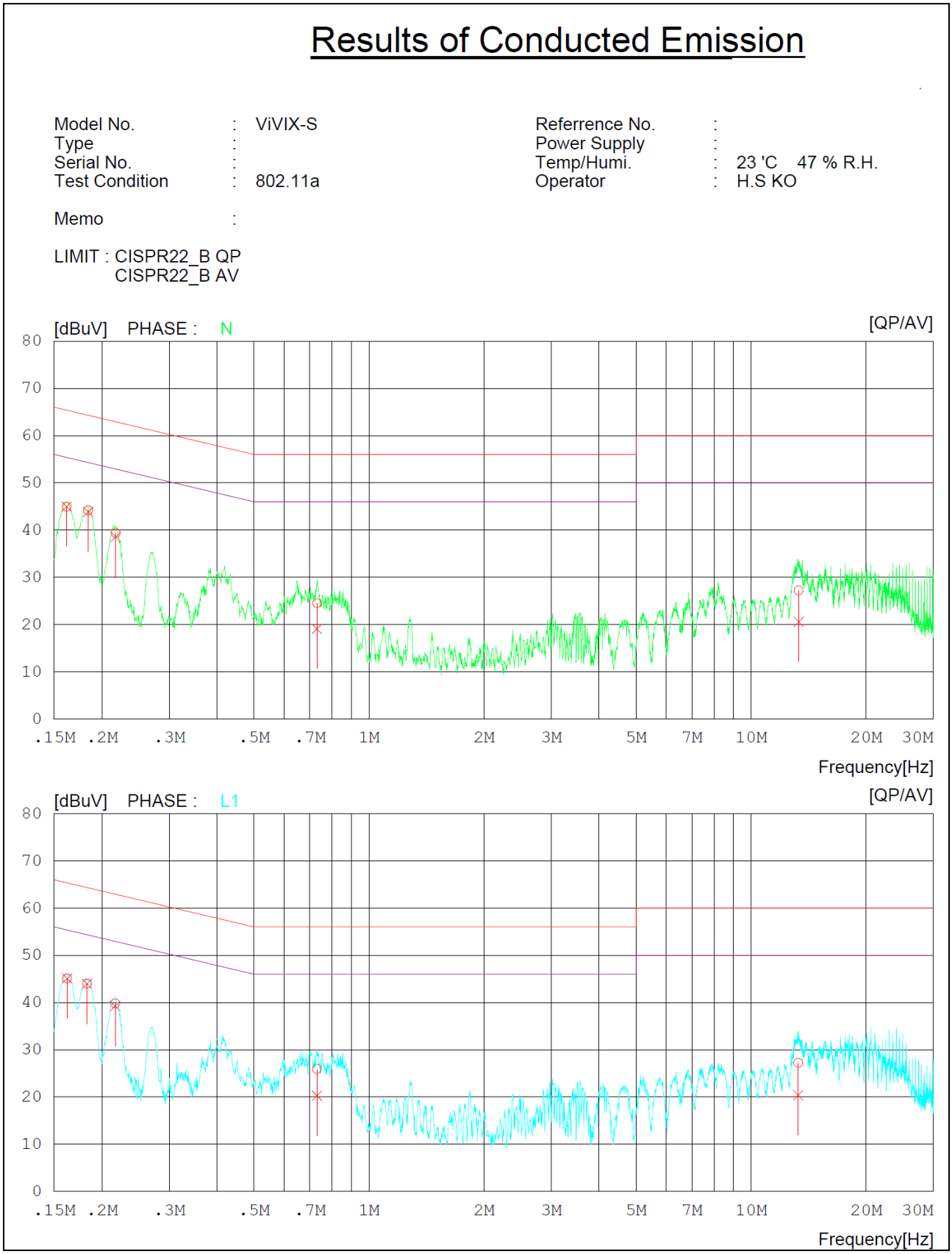


Table 1. Conducted Emissions Data Table

Model No.	:	ViVIX-S	Referrence No.	:	
Type	:		Power Supply	:	
Serial No.	:		Temp/Humi.	:	23 'C 47 % R.H.
Test Condition	:	802.11a	Operator	:	H.S KO

Memo :

LIMIT : CISPR22_B QP
CISPR22_B AV

NO	FREQ	READING QP	READING AV	C.FACTOR	RESULT QP	RESULT AV	LIMIT QP	LIMIT AV	MARGIN QP	MARGIN AV	PHASE
	[MHz]	[dBuV]	[dBuV]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	
1	0.16188	44.6	44.6	0.3	44.9	44.9	65.4	55.4	20.5	10.5	N
2	0.18428	44.0	43.7	0.2	44.2	43.9	64.3	54.3	20.1	10.4	N
3	0.21740	39.2	38.4	0.2	39.4	38.6	62.9	52.9	23.5	14.3	N
4	0.73055	24.3	18.9	0.2	24.5	19.1	56.0	46.0	31.5	26.9	N
5	13.32650	26.3	19.7	0.9	27.2	20.6	60.0	50.0	32.8	29.4	N
6	0.16228	44.8	44.8	0.3	45.1	45.1	65.3	55.3	20.2	10.2	L1
7	0.18289	43.9	43.8	0.2	44.1	44.0	64.4	54.4	20.3	10.4	L1
8	0.21670	39.6	39.0	0.2	39.8	39.2	62.9	52.9	23.1	13.7	L1
9	0.73085	25.8	20.1	0.2	26.0	20.3	56.0	46.0	30.0	25.7	L1
10	13.28450	26.4	19.5	0.9	27.3	20.4	60.0	50.0	32.7	29.6	L1

Figure.2. Conducted Emissions Graph

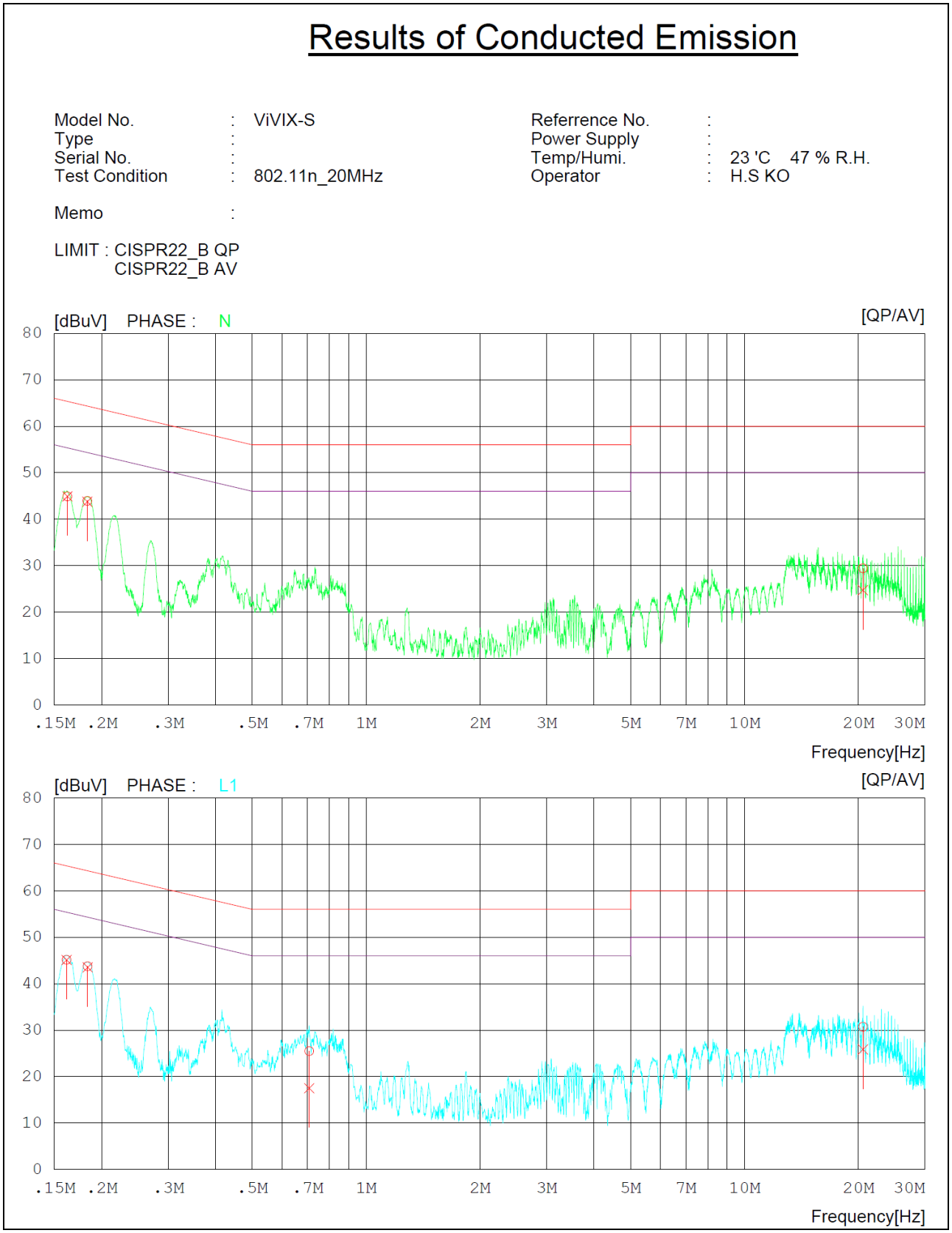


Table 2. Conducted Emissions Data Table

Model No.	:	ViVIX-S	Referrence No.	:	
Type	:		Power Supply	:	
Serial No.	:		Temp/Humi.	:	23 'C 47 % R.H.
Test Condition	:	802.11n_20MHz	Operator	:	H.S KO

Memo :

LIMIT : CISPR22_B QP
CISPR22_B AV

NO	FREQ	READING QP	READING AV	C.FACTOR	RESULT QP	RESULT AV	LIMIT QP	LIMIT AV	MARGIN QP	MARGIN AV	PHASE
	[MHz]	[dBuV]	[dBuV]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	
1	0.16245	44.6	44.6	0.3	44.9	44.9	65.3	55.3	20.4	10.4	N
2	0.18341	43.7	43.5	0.2	43.9	43.7	64.3	54.3	20.4	10.6	N
3	20.57350	28.3	23.6	1.1	29.4	24.7	60.0	50.0	30.6	25.3	N
4	0.16165	44.8	44.8	0.3	45.1	45.1	65.4	55.4	20.3	10.3	L1
5	0.18378	43.6	43.3	0.2	43.8	43.5	64.3	54.3	20.5	10.8	L1
6	0.70743	25.3	17.3	0.2	25.5	17.5	56.0	46.0	30.5	28.5	L1
7	20.57000	29.6	24.8	1.1	30.7	25.9	60.0	50.0	29.3	24.1	L1

Figure.3. Conducted Emissions Graph

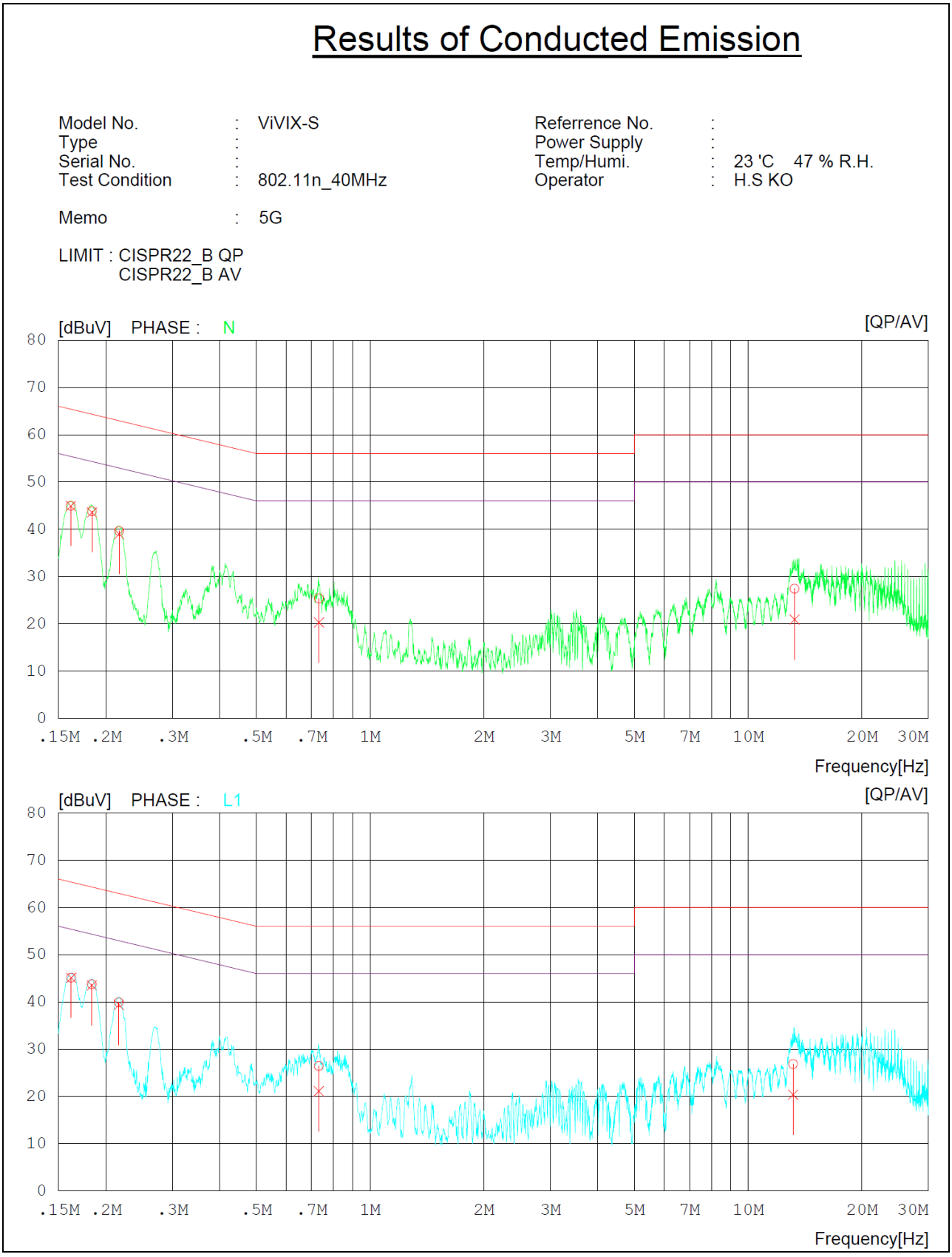


Table 3. Conducted Emissions Data Table

Model No.	:	ViVIX-S	Referrence No.	:	
Type	:		Power Supply	:	
Serial No.	:		Temp/Humi.	:	23 'C 47 % R.H.
Test Condition	:	802.11n_40MHz	Operator	:	H.S KO

Memo : 5G

LIMIT : CISPR22_B QP
CISPR22_B AV

NO	FREQ	READING QP	READING AV	C.FACTOR	RESULT QP	RESULT AV	LIMIT QP	LIMIT AV	MARGIN QP	MARGIN AV	PHASE
	[MHz]	[dBuV]	[dBuV]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	
1	0.16154	44.6	44.6	0.3	44.9	44.9	65.4	55.4	20.5	10.5	N
2	0.18383	43.6	43.3	0.2	43.8	43.5	64.3	54.3	20.5	10.8	N
3	0.21688	39.4	38.8	0.2	39.6	39.0	62.9	52.9	23.3	13.9	N
4	0.73239	25.2	20.1	0.2	25.4	20.3	56.0	46.0	30.6	25.7	N
5	13.27300	26.5	20.0	0.9	27.4	20.9	60.0	50.0	32.6	29.1	N
6	0.16206	44.8	44.8	0.3	45.1	45.1	65.4	55.4	20.3	10.3	L1
7	0.18365	43.5	43.3	0.2	43.7	43.5	64.3	54.3	20.6	10.8	L1
8	0.21641	39.7	39.2	0.2	39.9	39.4	63.0	53.0	23.1	13.6	L1
9	0.73180	26.2	20.9	0.2	26.4	21.1	56.0	46.0	29.6	24.9	L1
10	13.16050	26.0	19.5	0.9	26.9	20.4	60.0	50.0	33.1	29.6	L1