

47 CFR FCC Part 15 Subpart C

Section 15.249

TEST REPORT

Product : Transceiver

Trade Name : N/A

Model Number : RFK-X2-2N9

FCC ID : ELVNTRSA

Prepared for

Nutek Corporation

No.167, Lane 235, Bauchiau Rd., Xindian District,
New Taipei City 23145, Taiwan

TEL. : +886 2 2918 9478

FAX. : +886 2 2917 9069

Prepared by

Interocean EMC Technology Corp.

Interocean EMC Technology Tin-Fu Laboratory

No. 5-2, Lin 1, Tin-Fu, Lin-Kou Dist., New Taipei City,
Taiwan 244, R.O.C.

TEL.: +886 2 2600 6861

FAX: +886 2 2600 6859



Remark:

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The test result in this report is only subjected to the test sample.

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Statement of Compliance

Applicant: Nutek Corporation

Manufacturer: Nutek Corporation

Product: Transceiver

Model No.: RFK-X2-2N9

Tested Power Voltage: 12 Vdc

Date of Final Test: Jun. 11, 2019

Revision of Report: Rev. 01

Configuration of Measurements and Standards Used :

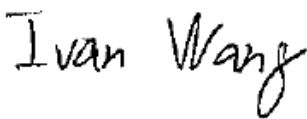
FCC Rules and Regulations Part 15 Subpart C

I HEREBY CERTIFY THAT: The data shown in this report were made in accordance with the procedures given in ANSI C63.10, and the energy emitted by the device was founded to be within the limits applicable. I assume full responsibility for accuracy and completeness of these data.

Note: 1. The result of the testing report relate only to the item tested.

2. The testing report shall not be reproduced expect in full, without the written approval of IETC

Report Issued: 2019/07/12

Project Engineer: 
Ivan Wang

Approved: 
K.C. Chen

1 General Information

1.1 Description of Equipment Under Test

Product	: Transceiver
Model Number	: RFK-X2-2N9
Applicant	: Nutek Corporation No.167, Lane 235, Bauchiau Rd., Xindian District, New Taipei City 23145, Taiwan
Manufacturer	: Nutek Corporation No.167, Lane 235, Bauchiau Rd., Xindian District, New Taipei City 23145, Taiwan
Power Supply	: 12 Vdc
Operating Frequency	: 909.60 MHz - 918.00 MHz
Channel Number	: 25 channels
Type of Modulation	: FSK
Antenna description	: This device uses Helix Antenna. Antenna gain: 0 dBi. The antenna is integral to the device, thereby meeting the requirement of FCC 15.203.
Measurement Software	: e3; Ver: 8.120803a7-2
Date of Test	: Apr. 12 ~ Jun. 11, 2019
Additional Description	: 1) The test model is “ RFK-X2-2N9 ” and included in this report. 2) For more detail specification about EUT, please refer to the user’s manual.

1.2 Details of tested peripheral equipment
N/A

1.3 Table for Channel Frequencies

Channel	Frequency
CH00	909.60
CH01	909.95
CH02	910.30
CH03	910.65
CH04	911.00
CH05	911.35
CH06	911.70
CH07	912.05
CH08	912.40
CH09	912.75
CH10	913.10
CH11	913.45
CH12	913.80
CH13	914.15
CH14	914.50
CH15	914.85
CH16	915.20
CH17	915.55
CH18	915.90
CH19	916.25
CH20	916.60
CH21	916.95
CH22	917.30
CH23	917.65
CH24	918.00

1.4 Hopping Sequence

12, 8, 6, 2, 0, 5, 1, 7, 3, 9, 4, 10, 15, 19, 13, 11, 16, 18, 14, 20, 22, 21, 24, 23, 17

1.5 Test Facility

- Site Description** : ☑Chamber 3
- Name of Firm** : Interocean EMC Technology Corp.
- Company web** : <http://www.ietc.com.tw>
- Location** : No. 5-2, Lin 1, Tin-Fu, Lin-Kou Dist., New Taipei City, Taiwan 244, R.O.C.
- Site Filing** : ● Federal Communication Commissions – USA
Designation No.: TW1020 (Test Firm Registration #: 651092)
Designation No.: TW1113 (Test Firm Registration #: 959554)
● Innovation, Science and Economic Development Canada (ISED)
CAB identifier: TW1113 (Ref. No 14962756)
● Voluntary Control Council for Interference by Information Technology Equipment (VCCI) – Japan
Member No.: 1349
Registration No. (Conducted Room): C-11094
Registration No. (Conducted Room): T-11562
Registration No. (OATS 1): R-11040; G-10274
- Site Accreditation** : ● Bureau of Standards and Metrology and Inspection (BSMI) – Taiwan, R.O.C.
Accreditation No.:
SL2-IN-E-0026 for CNS 13438 / CISPR 22
SL2-R1-E-0026 for CNS 13439 / CISPR 13
SL2-R2-E-0026 for CNS 13439 / CISPR 13
SL2-L1-E-0026 for CNS 14115 / CISPR 15
● Taiwan Accreditation Foundation (TAF)
Accreditation No.: 1113
● American Association for Laboratory Accreditation (A2LA)
Certificate Number: 4891.01
● Vehicle Safety Certification Center (VSCC)
Approval No.: TW16-11
● TÜV NORD
Certificate No: TNTW0801R

1.6 Test Equipment

Instrument	Manufacturer	Model	Serial No.	Next Cal. Date
EMI Test Receiver (30MHz to 1GHz)	R&S	ESI7	830154/002	2019/05/20
Spectrum Analyzer (above 1 GHz)	R&S	FSP40	100478	2019/06/14
Bilog Antenna (30MHz to 1GHz)	ETC	MCTD 2786B	BLB17S04020	2019/07/08
Horn Antenna (above 1 GHz)	Schwarzbeck	BBHA9120	9120D-1051	2019/11/05
Pre-Amplifier (30MHz to 1GHz)	EMCI	EMC001150	980130	2019/06/05
Pre-Amplifier (above 1 GHz)	EMCI	EMC 051845	980110	2019/09/05
RF Cable	HARBOUR	27478LL142	CBL65	2019/07/30
RF Cable	Marvelous Microwave	MCBL-LL266.50	CBL70	2019/07/30
Measurement Software	AUDIX-e3			

Note: The above equipments are within the valid calibration period.

1.7 Measurement Uncertainty

Item	Expended Uncertainty (k=2)
Chamber 3:	
Radiated Emission Test (30 MHz to 1 GHz)	5.1 dB
Radiated Emission Test (above 1 GHz)	4.9 dB

1.8 Summary of Measurement

Report Clause	Test Parameter	Reference Document CFR47 Part15	Results
3	RF Radiated spurious emission	§15.249(a)(c)(d)	PASS

1.9 Justification

The test of radiated measurements according to FCC Part15 Section 15.33(a) had been conducted and the field strength of the frequency band were all arrive limit requirement, thus we evaluate the EUT pass the specified test.

2 Test Specifications

2.1 Test Standard

The EUT was performed according to FCC Part 15 Subpart C Section 15.249 procedure and setup followed by ANSI C63.10, 2013 requirements.

2.2 Operation Mode

By preliminary testing and verifying three axis (X, Y and Z) position of EUT transmitted status, it was found that "Z axis" position was the worst, then the final test was executed the worst condition and test data were recorded in this report.

2.3 Test Step of EUT

- 2.3.1 Setup the EUT for battery.
- 2.3.2 Turn on the power of all equipment.
- 2.3.3 Let the EUT continuous transmission.
- 2.3.4 Executed the test.

3 RF Radiated Spurious Emission

3.1 Limit

According to FCC15.249 (a) the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

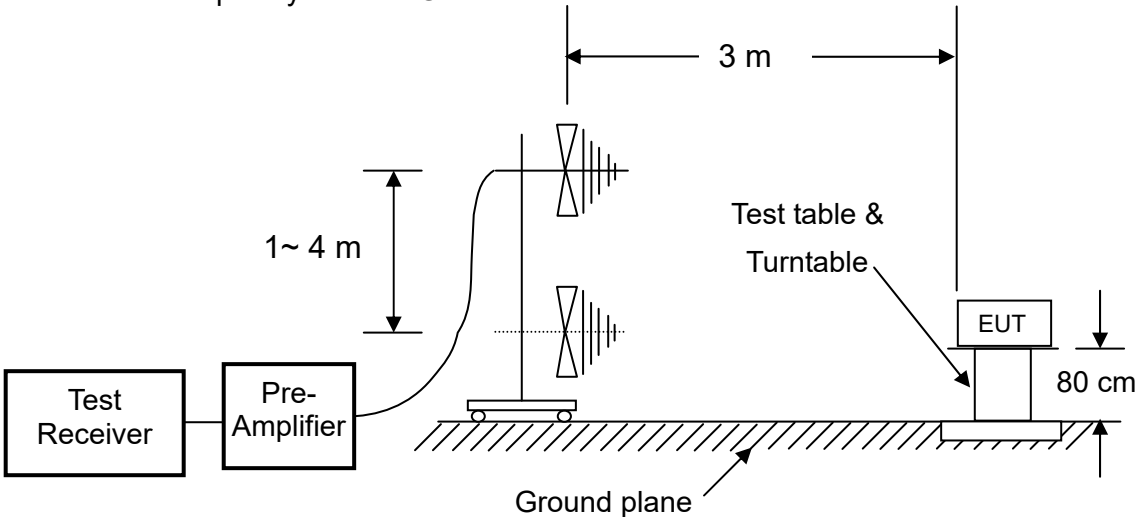
Fundamental frequency	Field strength of fundamental (millivolts/meter)	Field strength of harmonics (microvolts/meter)
902–928 MHz	50	500
2400–2483.5 MHz	50	500
5725–5875 MHz	50	500
24.0–24.25 GHz	250	2500

For intentional radiator, the radiated emission shall comply with §15.209(a).

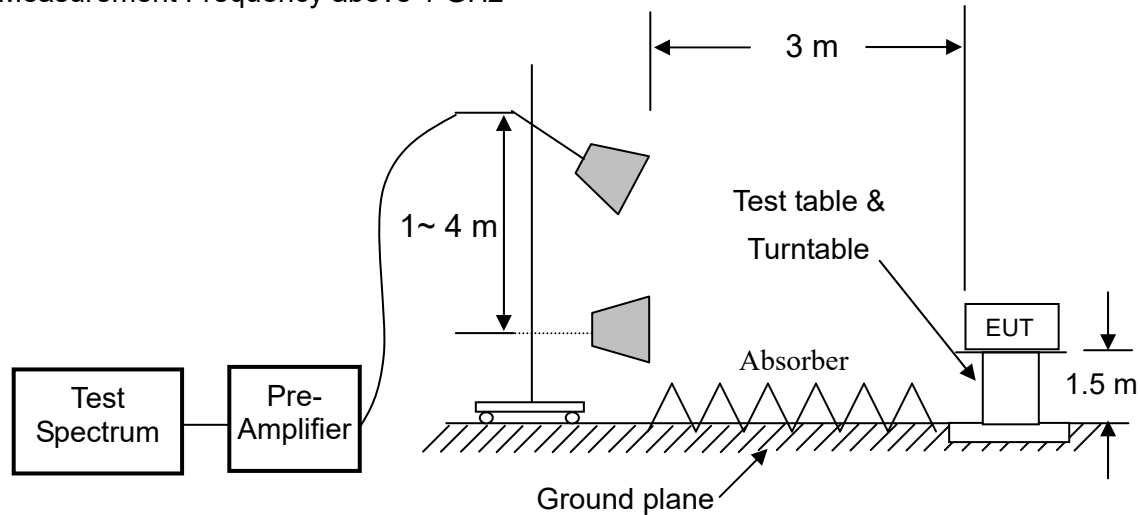
Frequency (MHz)	Field strength dB(μV/m)	Measurement distance (meters)
1.705~30.0	29.5	30
30 ~ 88	40	3
88~216	43.5	3
216~960	46	3
Above 960	54	3

3.2 Configuration of Measurement

Measurement Frequency under 1 GHz



Measurement Frequency above 1 GHz



3.3 Test Procedure

The EUT was setup to ANSI C63.10, 2013.

Radiated emission measurements were performed from 30MHz to 10GHz. Spectrum Analyzer set as below: For frequency range from 30MHz to 1GHz: RBW=100kHz or greater. For frequencies above 1GHz: set RBW=VBW=1MHz for peak detector and RBW=1MHz, VBW=10Hz for average detector.

The EUT for testing is arranged on a wooden turntable. If some peripherals apply to the EUT, the peripherals will be connected to EUT and the whole system. During the test, all cables were arranged to produce worst-case emissions. The signal is maximized through rotation. The height of antenna and polarization is changing constantly for exploring for maximum signal level. The height of antenna can be up to 4 meter and down to 1 meter.

3.4 Test Result

PASS.

The EUT has been tested low channel, middle channel and high channel, all test data pass the limit level.

The final test data is shown as following pages.

Fundamental Field Strength

Test Environment

Ambient temperature : 23.6°C
Relative humidity : 53%

Channel 0							
Frequency (MHz)	Antenna Polarization	Reading (dBμV)	Factor (dB/m)	Result Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Det. Mode
909.60	H	101.85	-10.56	91.29	94.00	-2.71	PK
	V	101.92	-10.57	91.35	94.00	-2.65	PK

Channel 12							
Frequency (MHz)	Antenna Polarization	Reading (dBμV)	Factor (dB/m)	Result Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Det. Mode
913.80	H	101.88	-10.41	91.47	94.00	-2.53	PK
	V	101.89	-10.40	91.49	94.00	-2.51	PK

Channel 24							
Frequency (MHz)	Antenna Polarization	Reading (dBμV)	Factor (dB/m)	Result Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Det. Mode
918.00	H	101.95	-10.26	91.69	94.00	-2.31	PK
	V	101.90	-10.26	91.64	94.00	-2.36	PK

Remark : Result Level = Reading + Factor
Factor = Antenna Factor + Cable Loss - Preamp
Margin = Result Level - Limits

Radiated spurious emission

Test Environment

Ambient temperature : 23.6°C

Relative humidity : 53%

Radiated Emission below 1GHz

After verifying low, middle and high channel (909.60MHz, 913.80MHz and 918.00MHz), the worse case was found at middle channel, the data will present on report.

Worst case: Channel 12							
Frequency (MHz)	Antenna Polarization	Reading (dBμV)	Factor (dB/m)	Result Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Det. Mode
150.280	H	53.44	-33.19	20.25	43.52	-23.27	QP
222.060	H	56.35	-35.36	20.99	46.02	-25.03	QP
482.990	H	52.40	-29.66	22.74	46.02	-23.28	QP
525.670	H	52.46	-29.28	23.18	46.02	-22.84	QP
704.150	H	52.99	-27.71	25.28	46.02	-20.74	QP
908.820	H	53.33	-24.29	29.04	46.02	-16.98	QP
59.110	V	70.51	-36.62	33.89	40.00	-6.11	QP
92.080	V	63.35	-37.25	26.10	43.52	-17.42	QP
148.340	V	61.97	-32.94	28.73	43.52	-14.79	QP
288.990	V	56.59	-32.50	24.09	46.02	-21.93	QP
372.410	V	58.49	-30.75	27.74	46.02	-18.28	QP
965.080	V	52.02	-22.24	29.81	54.00	-24.19	QP

Remark : Result Level = Reading + Factor

Factor = Antenna Factor + Cable Loss - Preamp

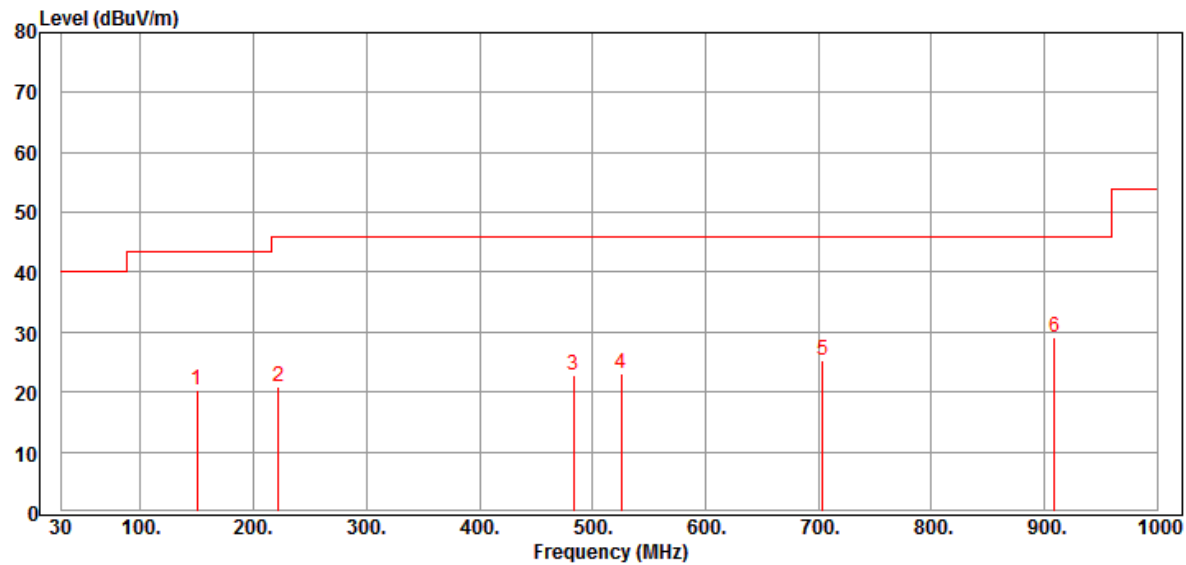
Margin = Result Level - Limits

CLIENT: Nutek Corporation
EUT: Transceiver
MODEL: RFK-X2-2N9
RATING: 12 Vdc
COMMENT: Channel 12

OPERATOR : Ivan
TEST SITE : Chamber 3
TEST DISTANCE : 3m
POLARIZATION : HORIZONTAL
TEMP/HUM : 23.6°C/53%

Data:4

2019-04-12

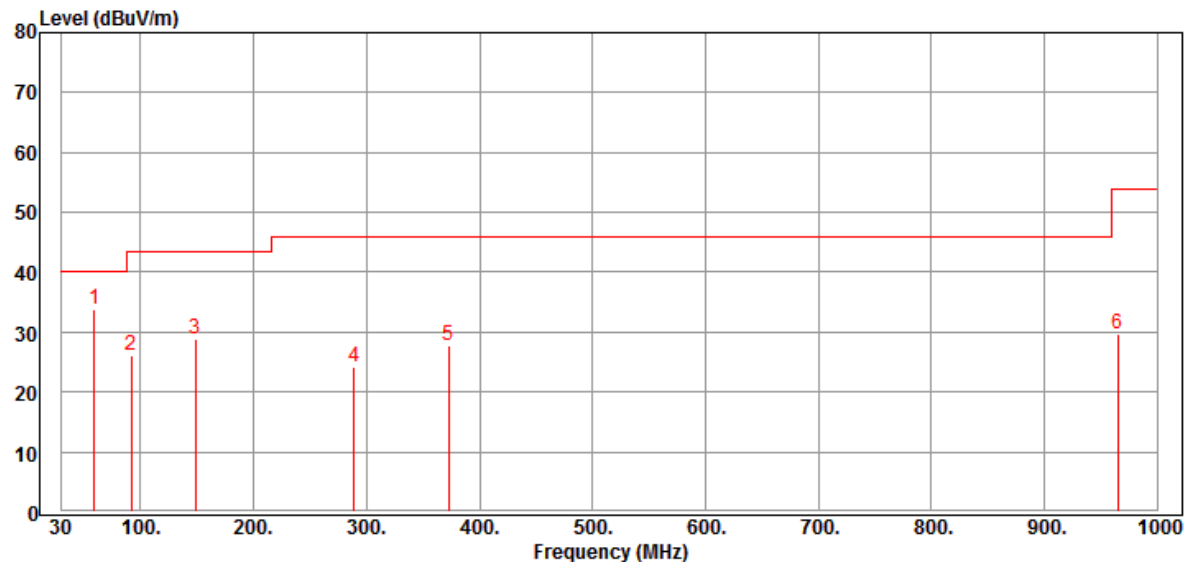


Item Mark	Freq. MHz	Reading dBuV	Factor dB/m	Level dBuV/m	Limit dBuV/m	Margin dB	Remark
1	150.280	53.44	-33.19	20.25	43.52	-23.27	QP
2	222.060	56.35	-35.36	20.99	46.02	-25.03	QP
3	482.990	52.40	-29.66	22.74	46.02	-23.28	QP
4	525.670	52.46	-29.28	23.18	46.02	-22.84	QP
5	704.150	52.99	-27.71	25.28	46.02	-20.74	QP
6	908.820	53.33	-24.29	29.04	46.02	-16.98	QP

CLIENT: Nutek Corporation
EUT: Transceiver
MODEL: RFK-X2-2N9
RATING: 12 Vdc
COMMENT: Channel 12

OPERATOR : Ivan
TEST SITE : Chamber 3
TEST DISTANCE : 3m
POLARIZATION : VERTICAL
TEMP/HUM : 23.6°C/53%

Data:2
2019-04-12



Item Mark	Freq. MHz	Reading dBuV	Factor dB/m	Level dBuV/m	Limit dBuV/m	Margin dB	Remark
1	59.100	70.51	-36.62	33.89	40.00	-6.11	QP
2	92.080	63.35	-37.25	26.10	43.52	-17.42	QP
3	148.340	61.67	-32.94	28.73	43.52	-14.79	QP
4	288.990	56.59	-32.50	24.09	46.02	-21.93	QP
5	372.410	58.49	-30.75	27.74	46.02	-18.28	QP
6	965.080	52.05	-22.24	29.81	54.00	-24.19	QP

Radiated spurious emission

Radiated Emission above 1GHz

Channel 0							
Frequency (MHz)	Antenna Polarization	Reading (dBμV)	Factor (dB/m)	Result Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Det. Mode
1816.00	H	71.45	-22.12	49.33	74.00	-24.67	PK
2734.00	H	65.89	-17.65	48.24	74.00	-25.76	PK
3634.00	H	60.14	-15.73	44.41	74.00	-29.59	PK
4546.00	H	60.22	-13.08	47.14	74.00	-26.86	PK
5458.00	H	58.18	-11.21	46.97	74.00	-27.03	PK
1816.00	V	69.42	-22.17	47.25	74.00	-26.75	PK
2734.00	V	68.35	-17.71	50.64	74.00	-23.36	PK
3634.00	V	67.48	-15.79	51.69	74.00	-22.31	PK
4546.00	V	65.45	-13.20	52.25	74.00	-21.75	PK
5458.00	V	63.89	-11.45	52.44	74.00	-21.56	PK

Channel 12							
Frequency (MHz)	Antenna Polarization	Reading (dBμV)	Factor (dB/m)	Result Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Det. Mode
1828.00	H	68.74	-22.12	46.62	74.00	-27.38	PK
2746.00	H	63.30	-17.69	45.61	74.00	-28.39	PK
3658.00	H	66.24	-15.75	50.49	74.00	-23.51	PK
4570.00	H	58.05	-13.14	44.91	74.00	-29.09	PK
5482.00	H	60.17	-11.29	48.88	74.00	-25.12	PK
1828.00	V	69.46	-22.12	47.34	74.00	-26.66	PK
2746.00	V	63.28	-17.69	45.59	74.00	-28.41	PK
3658.00	V	67.39	-15.75	51.64	74.00	-22.36	PK
4570.00	V	61.41	-13.14	48.27	74.00	-25.73	PK
5482.00	V	58.94	-11.29	47.65	74.00	-26.35	PK

Channel 24							
Frequency (MHz)	Antenna Polarization	Reading (dBμV)	Factor (dB/m)	Result Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Det. Mode
1837.00	H	69.70	-22.12	47.58	74.00	-26.42	PK
2758.00	H	66.89	-17.65	49.24	74.00	-24.76	PK
3670.00	H	61.18	-15.73	45.45	74.00	-28.55	PK
4594.00	H	63.42	-13.08	50.34	74.00	-23.66	PK
5512.00	H	57.48	-11.21	46.27	74.00	-27.73	PK
1837.00	V	69.19	-22.12	47.07	74.00	-26.93	PK
2758.00	V	62.17	-17.65	44.52	74.00	-29.48	PK
3670.00	V	63.98	-15.73	48.25	74.00	-25.75	PK
4594.00	V	63.32	-13.08	50.24	74.00	-23.76	PK
5512.00	V	59.33	-11.21	48.12	74.00	-25.88	PK

Remark : Result Level = Reading + Factor

Factor = Antenna Factor + Cable Loss - Preamp

Margin = Result Level - Limits

The spurious emissions above 6GHz were not included, because the emissions are too low.