



DATE: 13 May 2019

I.T.L. (PRODUCT TESTING) LTD. FCC Radio Test Report

for

Mottech Water Solutions Ltd.

Equipment under test:

Irrigation Controller

**Piccolo XR PLUS
(450-470MHz)**

Tested by:


M. Zohar

Approved by:


D. Shidlow

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Measurement/Technical Report for Mottech Water Solutions Ltd.

Irrigation Controller

Piccolo XR PLUS

FCC ID: 2APCUMO515A

This report concerns: Original Grant:
 Class II change: X
 Class I change:

Equipment Class: TNB – Licensed Non-Broadcast Station Transmitter

Limits used: 47CFR Parts 2; 90

Measurement procedure used is KDB 971168 D03 v01 and KDB 935210 D05 v01r01

Substitution Method used as in ANSI/TIA-603-D: 2010.

Application for Certification
prepared by:
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Applicant for this device:
(different from "prepared by")
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1. General Information

1.1 Administrative Information

Manufacturer: Mottech Water Solutions Ltd.

Manufacturer's Address: 11 Hamelacha Street
Rosh-Ha'Ayin 4809121
Israel
Tel: +972 54-597-0428
Fax: +972 9-961- 6029

Manufacturer's Representative: Amir Givon

Equipment Under Test (E.U.T): Irrigation Controller

Equipment Model No.: Piccolo XR PLUS

Equipment Serial No.: Not designated

Date of Receipt of E.U.T: May 15, 2018

Start of Test: May 15, 2018

End of Test: July 24, 2018

Test Laboratory Location: I.T.L (Product Testing) Ltd.
1 Batsheva St,
Lod,
Israel 7116002

Test Specifications: FCC Parts 2; 90



1.2 List of Accreditations

The EMC laboratory of I.T.L. is accredited by/registered with the following bodies:

1. The American Association for Laboratory Accreditation (A2LA) (U.S.A.), Certificate No. 1152.01.
2. The Federal Communications Commission (FCC) (U.S.A.), FCC Designation Number is IL1005.
3. The Israel Ministry of the Environment (Israel), Registration No. 1104/01.
4. Industry Canada (Canada), IC File No.: 46405-4025; Site No. IC 4025A-1, IC 4025A-2.

I.T.L. Product Testing Ltd. is accredited by the American Association for Laboratory Accreditation (A2LA) and the results shown in this test report have been determined in accordance with I.T.L.'s terms of accreditation unless stated otherwise in the report.

1.3 Product Description

The Piccolo–XR Plus is an intelligent, microprocessor based unit that can be used to monitor and control local units in a multi-unit communication network.

Piccolo–XR Plus units communicate data to a PIU while functioning as intelligent nodes in Distributed I/O monitor and control systems. The Piccolo–XR Plus is often used in irrigation and water distribution systems (i.e. irrigation valves, water meters, fertilizing meters, various sensors, flushing filters, and other non-irrigation devices).

The Piccolo–XR Plus is ideal for use in applications where very low power consumption is essential. The Piccolo–XR Plus is also available in an outdoor resistant housing (IP66), designed to resist harsh environment, such as exposure to sun, dust, and pouring rain.

1.4 Test Methodology

Both conducted and radiated testing were performed according to the procedures in KDB 971168 D03 v01, KDB 935210 D05 v01r01 and ANSI/TIA-603-D: 2010.

Radiated testing was performed at an antenna to EUT distance of 3 meters.

1.5 Test Facility

Both conducted and radiated emissions tests were performed at I.T.L.'s testing facility in Lod, Israel. I.T.L.'s EMC Laboratory is accredited by A2LA, certificate No. 1152.01 and its FCC Designation Number is IL1005.

1.6 Measurement Uncertainty

Conducted Emission (CISPR 11, EN 55011, CISPR 22, EN 55022, ANSI C63.4)
0.15 – 30 MHz:

Expanded Uncertainty (95% Confidence, K=2):

± 3.44 dB

Radiated Emission (CISPR 11, EN 55011, CISPR 22, EN 55022, ANSI C63.4) for
open site 30-1000MHz:

Expanded Uncertainty (95% Confidence, K=2):

± 4.98 dB

2. System Test Configuration

2.1 *Justification*

1. On 02/07/2019 a FCC ID Change Grant was approved for the E.U.T. under FCC ID: 2APCUMO515A.
2. Subsequently, the following C2PC changes were made to the E.U.T. (See customer's declaration on page 9.
 - a) An expansion card has been added;
 - b) The cable connector has been replaced;
 - c) The back cover has been replaced;
 - d) The front logo plate has been replaced;
 - e) The connection between the original card and the expansion card is done outside the unit case;
 - f) There is no change in the radio of the original device.
3. The following C2PC tests were performed: RF Power Output, Occupied Bandwidth, Spurious Emissions at Antenna Terminals and Spurious Radiated
4. The E.U.T. meets the requirements for a C2PC.
5. The E.U.T operates in the 450-470MHz bands and was evaluated while transmitting at: 450.0125MHz, 460.0125MHz and 469.9875MHz.

2.2 *EUT Exercise Software*

No exercise software was used to achieve compliance.

2.3 *Special Accessories*

(Piccolo Interface Unit) PIU unit: model- F4604B
s/n: 870STS12KF

2.4 *Equipment Modifications*

No modifications were necessary in order to achieve compliance.

2.5 Configuration of Tested System

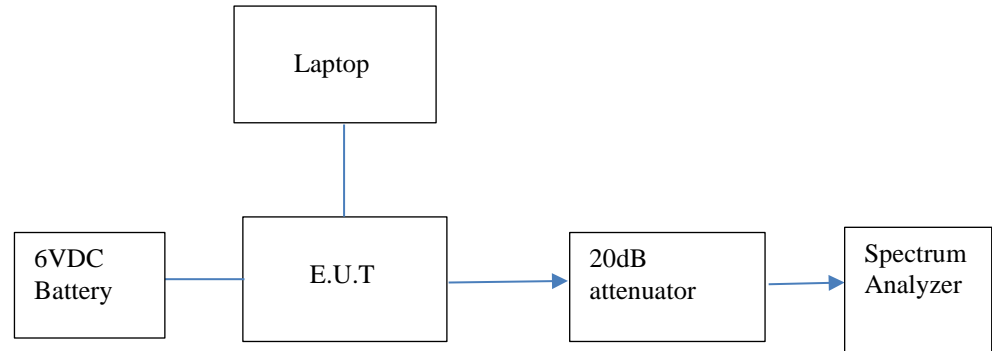


Figure 1. Conducted Test Set-Up

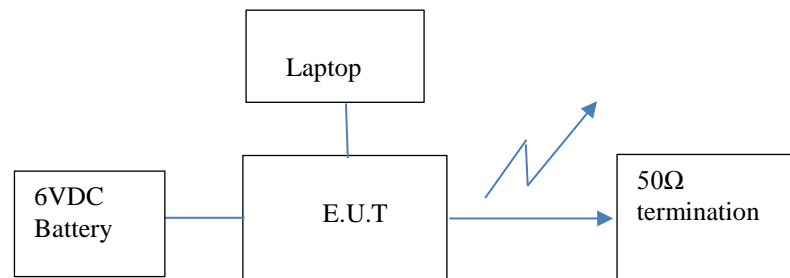


Figure 2. Radiated Test Set-Up



May 13, 2019

To: Federal Communications Commission Authorization and Evaluation Division

Subject: Permissive Change Class II for Mottech Water Solutions Ltd, Piccolo XR Plus
Controller - FCC ID: 2APCUMO515A

To whom it may concern,

On 02/07/2019, an FCC ID Change Grant was approved for the E.U.T. which is now under FCC ID: 2APCUMO515A.

The following C2PC changes were made to the device.

1. An expansion card has been added;
2. The cable connector has been replaced;
3. The back cover has been replaced;
4. The front logo plate has been replaced;
5. The connection between the original card and the expansion card is done outside the unit case;
6. The device was originally certified as body worn. It is no longer a body worn device but is a fixed irrigation controller. The distance between the user and the EUT is at least 20cm.
7. There is no change in the radio of the original device.

We request a Permissive Change Class II based on the above.

Thank you for your assistance.

Amir Givon

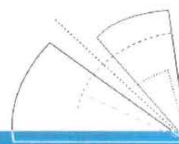
Amir Givon, Marketing Manager

Mottech Water Solutions Ltd.

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 **Take Control!**



3. Test Set-Up Photos



Figure 3. Conducted Emission from Antenna Ports Test

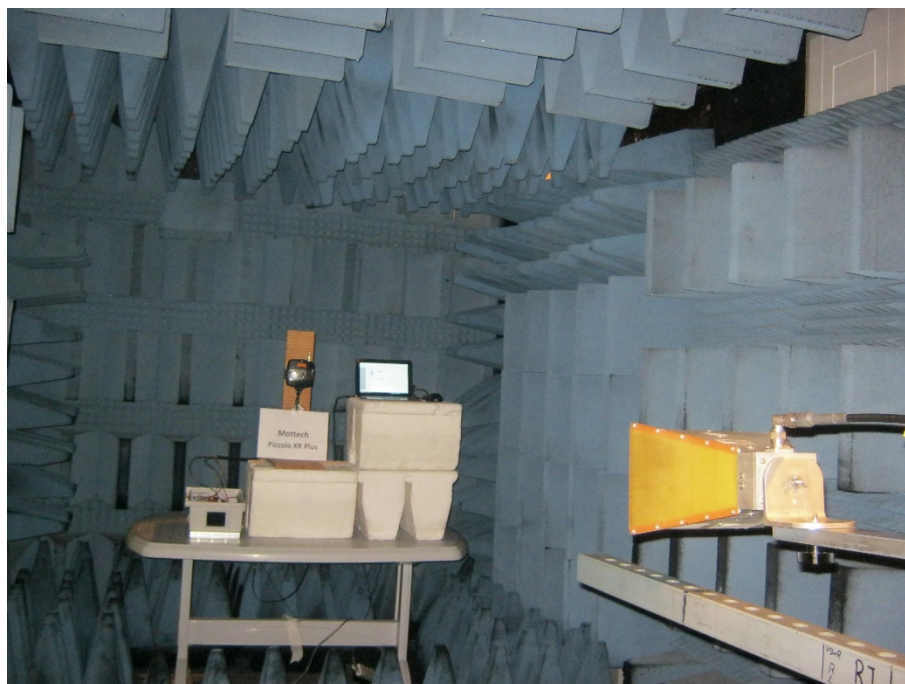


Figure 4. Radiated Emission Test

4. RF Power Output

4.1 Test Specification

FCC Part 90, Subpart I, Section 205

4.2 Test Procedure

(Temperature (20°C)/ Humidity (53%RH))

The E.U.T. antenna terminal was connected to the Spectrum Analyzer through an external attenuator (21.0 dB) and an appropriate coaxial cable. Special attention was taken to prevent Spectrum Analyzer RF input overload.

4.3 Test Limit

The power limit is 20.8dBm.

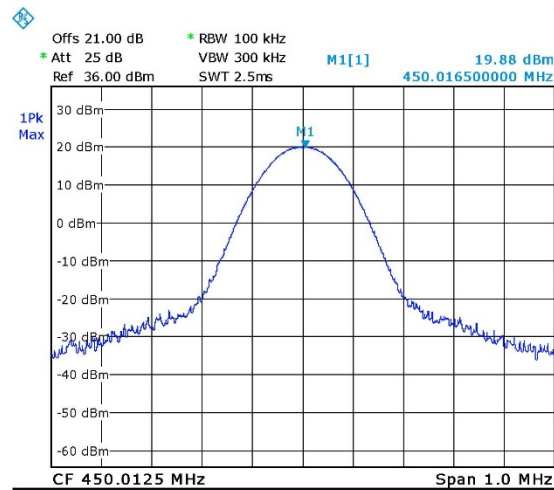
4.4 Test Results

UNIT	Operation Frequency	Reading	Limit	Margin
(Original/New)	(MHz)	(dBm)	(dBm)	(dB)
Original	450.0125	20.2	20.8	-0.6
	460.0125	20.3	20.8	-0.5
	469.9875	20.3	20.8	-0.5
New	450.0125	19.9	20.8	-0.9
	460.0125	19.6	20.8	-1.2
	469.9875	19.7	20.8	-1.1

Figure 5 RF Power Output

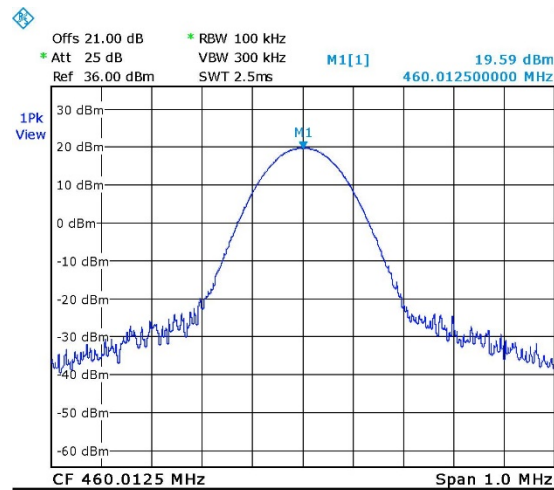
JUDGEMENT: Passed

See additional information in *Figure 6* to *Figure 8*.



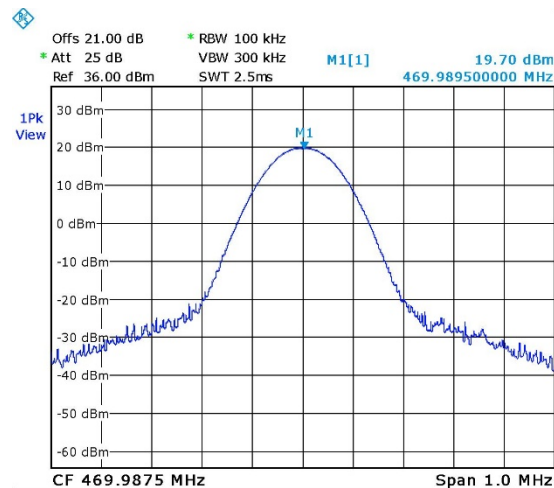
Date: 15.MAY.2018 09:43:15

Figure 6 Frequency 450.0125MHz, New



Date: 15.MAY.2018 09:48:15

Figure 7 Frequency 460.0125MHz, New



Date: 15.MAY.2018 09:52:28

Figure 8 Frequency 469.9875MHz, New



4.5 Test Equipment Used; RF Power Output

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibration Date	Next Calibration Due
Spectrum Analyzer	R&S	FSL6	100194	February 19, 2018	February 19, 2019
RF Cable	EIM	A009301EIM	-	October 1, 2017	October 1, 2018
20 dB Attenuator	Microwave Midwest	ATT-0217-20-NNN-02	-	October 1, 2017	October 1, 2018

Figure 9 Test Equipment Used

5. Occupied Bandwidth

5.1 Test Specification

FCC Part 2, Section 2.1049

5.2 Test Procedure

(Temperature (20°C)/ Humidity (53%RH))

The E.U.T. antenna terminal was connected to the spectrum analyzer through an external attenuator and an appropriate coaxial cable (loss=21.0 dB). The spectrum analyzer was set to proper resolution B.W.

OBW function (99%) was employed for this evaluation.

5.3 Test Limit

Not applicable

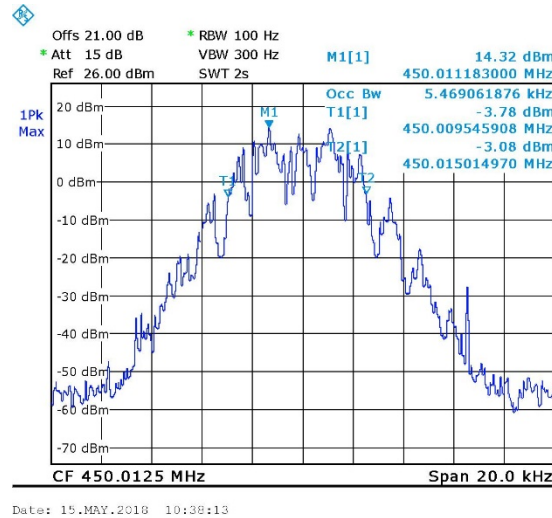
5.4 Test Results

Operating Frequency	Reading
(MHz)	(kHz)
450.0125	5.469
460.0125	5.588
469.9875	5.508

Figure 10 Occupied Bandwidth

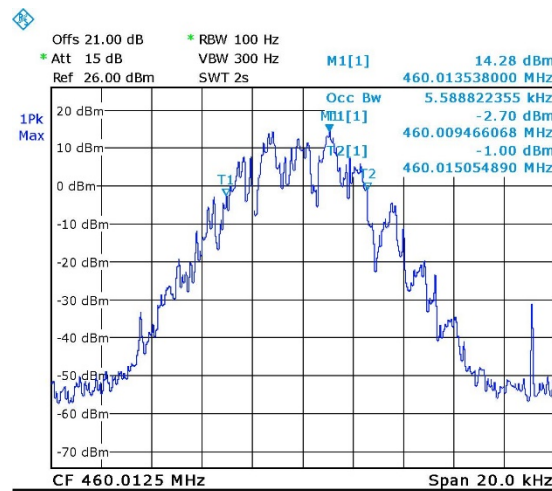
JUDGEMENT: Passed

See additional information in *Figure 11* to *Figure 13*.



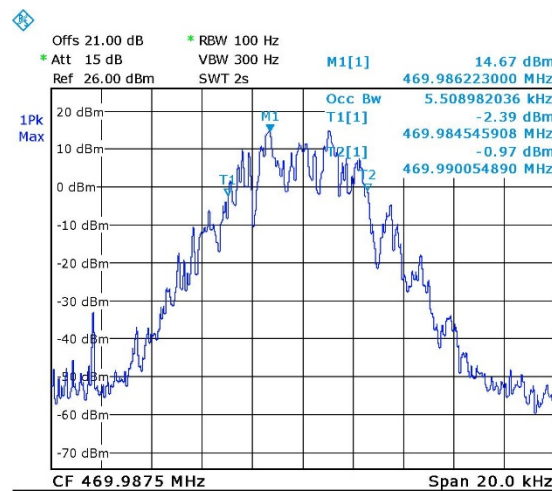
Date: 15.MAY.2018 10:38:13

Figure 11. — Frequency 450.0125MHz



Date: 15.MAY.2018 10:44:50

Figure 12. — Frequency 460.0125MHz



Date: 15.MAY.2018 10:51:50

Figure 13. — Frequency 469.9875MHz

5.5 Test Equipment Used; Occupied Bandwidth

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibration Date	Next Calibration Due
Spectrum Analyzer	R&S	FSL6	100194	February 19, 2018	February 19, 2019
RF cable	EIM	A009301EIM	-	October 1, 2017	October 1, 2018
20 dB Attenuator	Microwave Midwest	ATT-0217-20-NNN-02	-	October 1, 2017	October 1, 2018

Figure 14 Test Equipment Used

6. Spurious Emissions at Antenna Terminals

6.1 Test Specification

FCC Part 90, Subpart I, Section: 217

6.2 Test Procedure

(Temperature (20°C)/ Humidity (52%RH))

The E.U.T. antenna terminal was connected to the spectrum analyzer through an external attenuator and an appropriate coaxial cable (max loss =32.0 dB). The spectrum analyzer was set to 300Hz resolution BW for the frequency range 9.0-150.0 kHz, 10.0 kHz for the frequency range 150.0 kHz–30.0 MHz, 100.0 kHz for the frequency range 30.0–1000.0 MHz, and 1.0MHz for the frequency range 1.0-5.0 GHz.

6.3 Test Limit

The power of any emission outside of the authorized operating frequency ranges must be attenuated more than 30dBc.

6.4 Test Results

JUDGEMENT: Passed

See additional information in *Figure 15* to *Figure 26*.

Results for new unit:

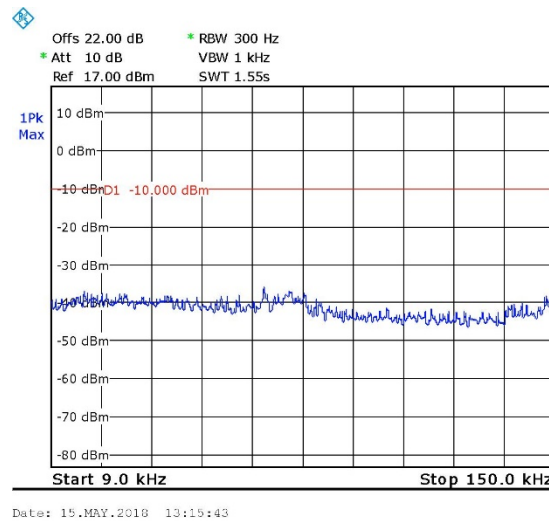


Figure 15 Frequency Operation 450.0125MHz, 9-150 kHz band

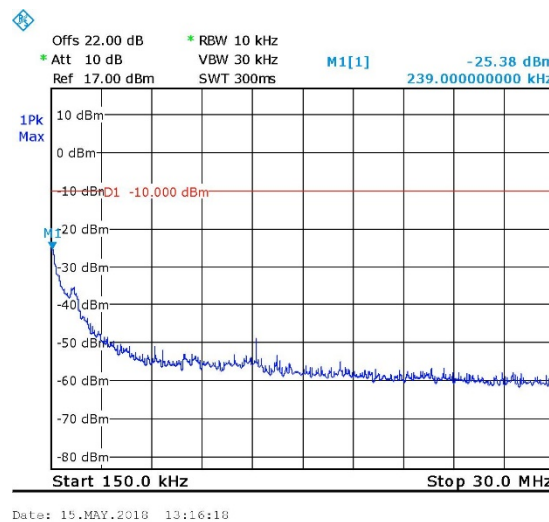


Figure 16 Frequency Operation 450.0125MHz, 0.15-30MHz band

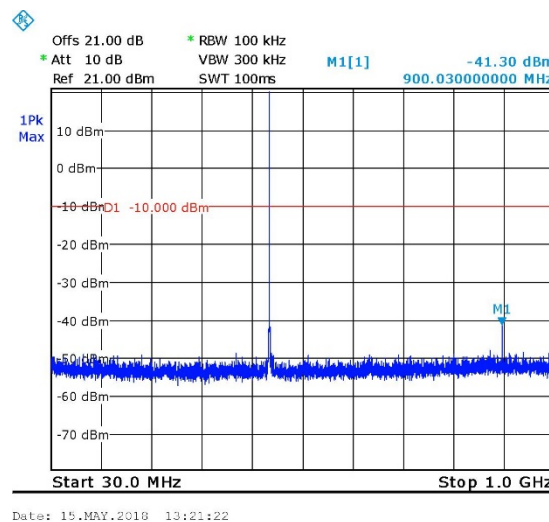


Figure 17 Frequency Operation 450.0125MHz, 30-1000MHz band

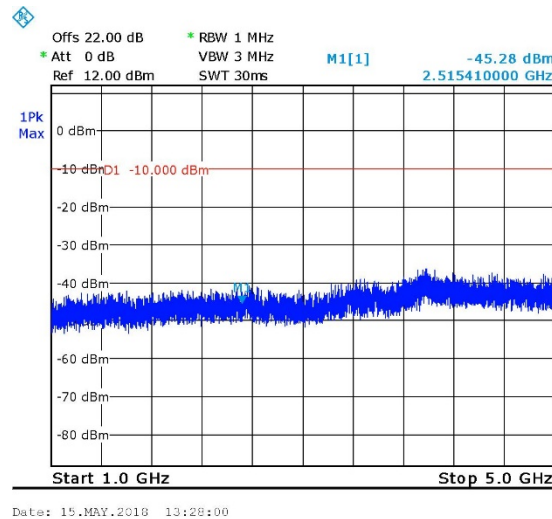


Figure 18 Frequency Operation 450.0125MHz, 1000-5000MHz band

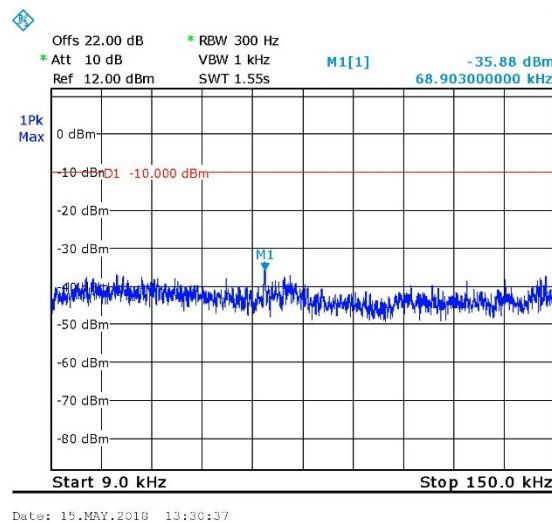


Figure 19 Frequency Operation 460.0125MHz, 9-150 kHz band

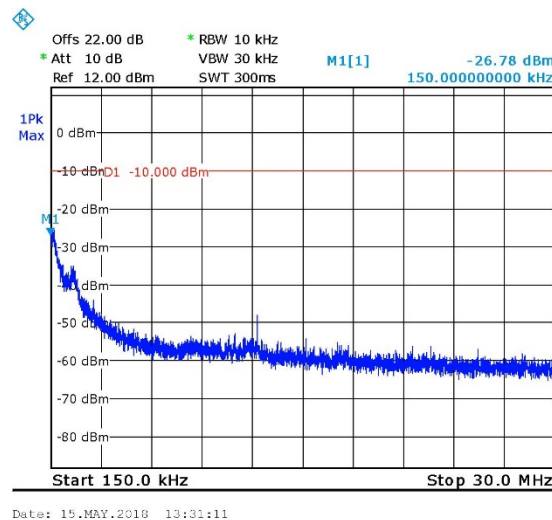


Figure 20 Frequency Operation 460.0125MHz, 0.15-30MHz band

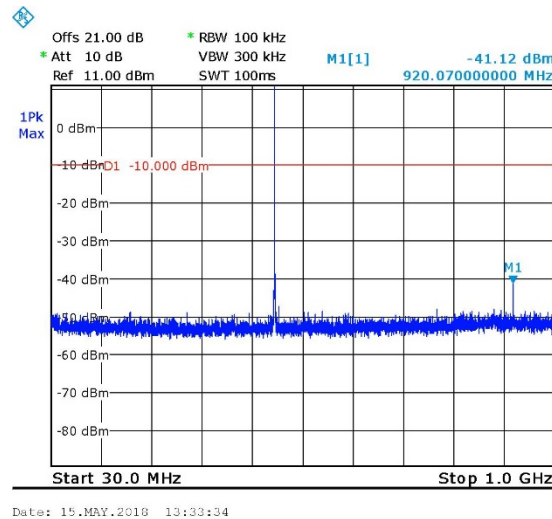


Figure 21 Frequency Operation 460.0125MHz, 30-1000MHz band

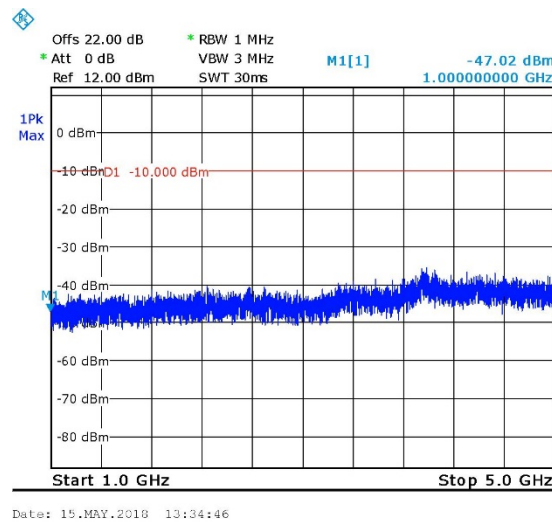


Figure 22 Frequency Operation 460.0125MHz, 1000-5000MHz band

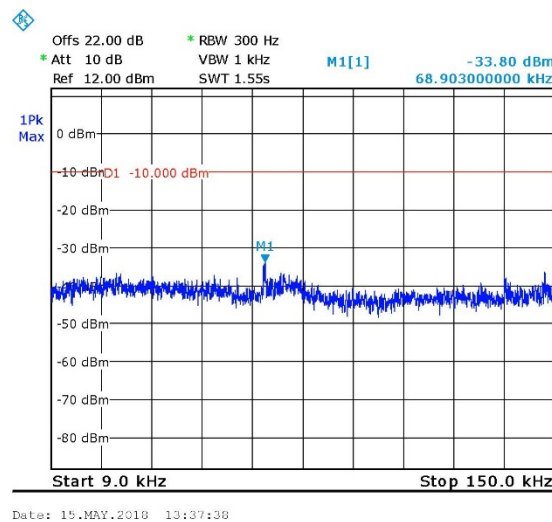


Figure 23 Frequency Operation 469.9875MHz, 9-150 kHz band

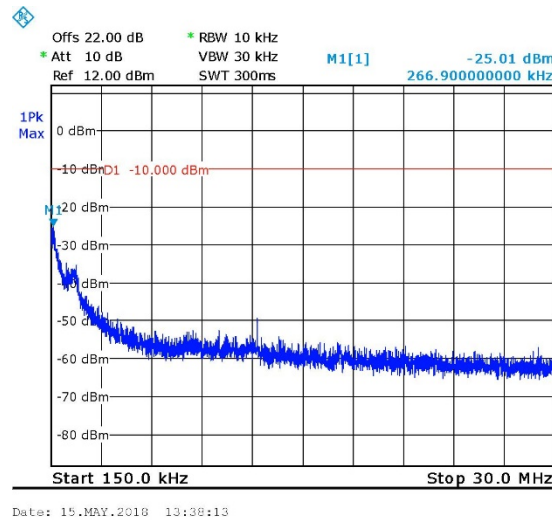


Figure 24 Frequency Operation 469.9875MHz, 0.15-30MHz band

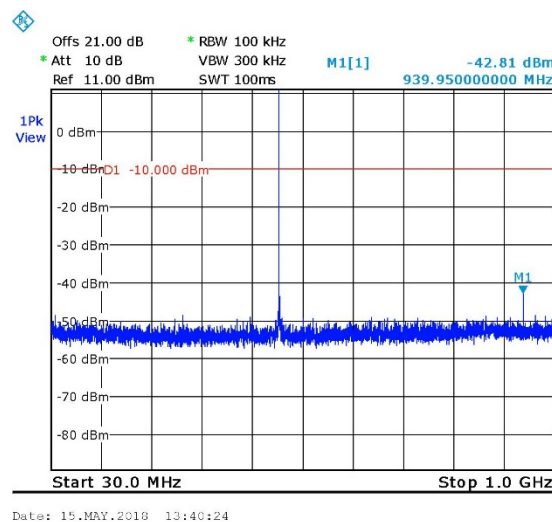


Figure 25 Frequency Operation 469.9875MHz, 30-1000MHz band

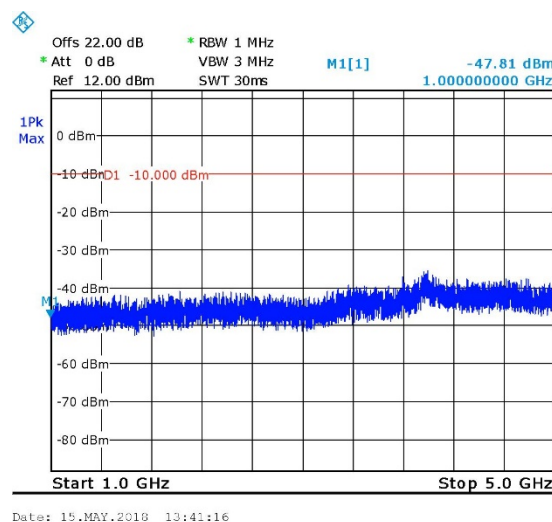


Figure 26 Frequency Operation 469.9875MHz, 1000-5000MHz band



6.5 Test Equipment Used; Spurious Emissions at Antenna Terminals

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibration Date	Next Calibration Due
Spectrum Analyzer	R&S	FSL6	100194	February 19, 2018	February 19, 2019
RF cable	EIM	A009301EIM	-	October 1, 2017	October 1, 2018
20 dB Attenuator	Microwave Midwest	ATT-0217-20-NNN-02	-	October 1, 2017	October 1, 2018

Figure 27 Test Equipment Used

8. Spurious Radiated Emission

8.1 Test Specification

FCC, Part 27, Subpart C, Section 27.53(h)

8.2 Test Procedure

(Temperature (28°C)/ Humidity (57%RH))

The test method was based on ANSI/TIA-603-D: 2010, Section 2.2.12 Unwanted Emissions: Radiated Spurious.

The E.U.T. operation mode and test set-up are as described in Section 2 of this report.

For measurements between 0.009MHz-30.0MHz:

The E.U.T was tested inside the shielded room at a distance of 3 meters and the E.U.T was placed on a non-metallic table, 0.8 meters above the ground. The frequency range 0.009MHz-30MHz was scanned. The readings were maximized by the turntable azimuth between 0-360°, and the antenna polarization.

The emissions were measured at a distance of 3 meters.

For measurements between 30.0MHz-1.0GHz:

A preliminary measurement to characterize the E.U.T was performed inside the shielded room at a distance of 3 meters, using peak detection mode and broadband antennas. The preliminary measurements produced a list of the highest emissions. The E.U.T was then transferred to the open site, and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 0.8 meters above the ground. The frequency range 30.0MHz -1.0GHz was scanned and the list of the highest emissions was verified and updated accordingly.

The readings were maximized by adjusting the antenna height between 1-4 meters, the turntable azimuth between 0-360°, and the antenna polarization.

The emissions were measured at a distance of 3 meters.

For measurements between 1.0GHz-5.0GHz:

The E.U.T was tested inside the shielded room at a distance of 3 meters and the E.U.T was placed on a non-metallic table, 1.5 meters above the ground. The frequency range 1.0GHz -5.0GHz was scanned. The readings were maximized by the turntable azimuth between 0-360°, and the antenna polarization.

The emissions were measured at a distance of 3 meters.

The E.U.T. was replaced by a substitution antenna (dipole 30MHz-1GHz, Horn Antenna above 1GHz) driven by a signal generator. The height was readjusted for maximum reading. The signal generator level was adjusted to obtain the same reading on the EMI receiver as in step (a).

The signals observed in step (a) were converted to radiated power using:

$$P_d(\text{dBm}) = P_g(\text{dBm}) - \text{Cable Loss (dB)} + \text{Substitution Antenna Gain (dBd)}$$

P_d = Dipole equivalent power (result).

P_g = Signal generator output level.

A Peak detector was used for this test.

The test was performed in 3 operation frequencies: low, mid and high.

Testing was performed when the RF port was connected to 50 Ω termination.

The table below describe only results with the highest radiation.

8.3 Test Limit

The power of any emission outside of the authorized operating frequency ranges must be attenuated more than 30dBc.

8.4 Test Results

Carrier Channel	Freq.	Antenna Pol.	Maximum Peak Level	Signal Generator RF Output	Cable Loss	Antenna Gain	Effective Radiated Power Level	Limit	Margin
(MHz)	(MHz)	(V/H)	(dB μ V/m)	(dBm)	(dB)	(dBd)	(dBm)	(dBm)	(dB)
450.0125	1350.037	V	49.6	-50.0	0.5	7.1	-43.4	-10.0	-33.4
	1350.037	H	50.1	-51.3	0.5	7.1	-44.7	-10.0	-34.7
460.0125	1380.037	V	50.3	-50.0	0.5	7.1	-43.4	-10.0	-33.4
	1380.037	H	50.2	-51.3	0.5	7.1	-44.7	-10.0	-34.7
469.9875	1409.96	V	50.5	-49.5	0.5	7.1	-42.9	-10.0	-32.9
	1409.96	H	50.7	-50.8	0.5	7.1	-44.2	-10.0	-34.2

Figure 28 Spurious Radiated Emission, New

JUDGEMENT: Passed by 32.9dB

The E.U.T met the requirements of the FCC, Part 27, Subpart C, Section 27.53 (h) specifications.

8.5 Test Instrumentation Used, Radiated Measurements

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibration Date	Next Calibration Due
EMI Receiver	HP	8542E	3906A00276	February 19, 2018	February 19, 2019
RF Filter Section	HP	85420E	3705A00248	February 19, 2018	February 19, 2019
EMI Receiver	R&S	ESCI7	100724	February 19, 2018	February 19, 2019
Spectrum Analyzer	HP	8593EM	3536A00120ADI	February 20, 2018	February 20, 2019
Active Loop Antenna	EMCO	6502	9506-2950	October 19, 2017	October 19, 2018
Antenna Biconical	EMCO	3110B	9912-3337	March 24, 2016 May 31, 2018	May 31, 2018 May 31, 2019
Antenna Log Periodic	EMCO	3146	9505-4081	April 23, 2016 May 31, 2018	May 31, 2018 May 31, 2019
Horn Antenna 1G-18G	ETS	3115	29845	May 19, 2015 May 31, 2018	May 19, 2018 May 31, 2019
Horn Antenna 18G-26G	ARA	SWH-28	1007	December 13, 2017	December 13, 2020
Low Noise Amplifier	Narda	LNA-DBS-0411N313	013	October 1, 2017	October 1, 2018
Low Noise Amplifier	Sophia Wireless	LNA 28-B	232	October 1, 2017	October 1, 2018
Semi Anechoic Civil Chamber	ETS	S81	SL 11643	NCR	NCR
Antenna Mast	ETS	2070-2	-	NCR	NCR
Turntable	ETS	2087	-	NCR	NCR
Mast & Table Controller	ETS/EMCO	2090	9608-1456	NCR	NCR

Figure 29 Test Equipment Used

9. APPENDIX A - CORRECTION FACTORS

9.1 Correction factors for RF OATS Cable 35m ITL #1911

Frequency (MHz)	Ref&cable loss (dBm)	Ref loss (dBm)	Cable loss (dB)
1.00	0.7	0.2	0.5
10.00	1.3	0.3	1
20.00	1.7	0.3	1.34
30.00	2.0	0.5	1.5
50.00	2.3	0.5	1.83
100.00	3.0	0.3	2.67
150.00	3.7	0.5	3.17
200.00	4.3	0.5	3.83
250.00	4.5	0.3	4.17
300.00	5.0	0.5	4.5
350.00	5.7	0.5	5.17
400.00	6.0	0.5	5.5
450.00	6.5	0.7	5.83
500.00	6.8	0.5	6.33
550.00	7.2	0.5	6.67
600.00	7.5	0.7	6.83
650.00	7.7	0.5	7.17
700.00	8.3	0.7	7.66
750.00	8.5	0.7	7.83
800.00	8.8	0.7	8.16
850.00	9.0	0.5	8.5
900.00	9.5	0.7	8.83
950.00	9.7	0.8	8.84
1000.00	9.7	0.7	9

9.2 Correction factor for RF CABLE for Semi Anechoic Chamber

ITL # 1841

FREQ (MHz)	LOSS (dB)
1000.0	1.5
2000.0	2.1
3000.0	2.7
4000.0	3.1
5000.0	3.5
6000.0	4.1
7000.0	4.6
8000.0	4.9
9000.0	5.7
10000.0	5.7
11000.0	6.1
12000.0	6.1
13000.0	6.2
14000.0	6.7
15000.0	7.4
16000.0	7.5
17000.0	7.9
18000.0	8.1
19000.0	8.8
20000.0	9.1

NOTES:

1. The cable is manufactured by Commscope
2. The cable type is 0623 WBC-400, serial # G020132 and 10m long



9.3 Correction factors for Active Loop Antenna

Model 6502 S/N 9506-2950

ITL # 1075:

f(MHz)	MAF(dBs/m)	AF(dB/m)
0.01	-33.1	18.4
0.02	-37.2	14.3
0.03	-38.2	13.3
0.05	-39.8	11.7
0.1	-40.1	11.4
0.2	-40.3	11.2
0.3	-40.3	11.2
0.5	-40.3	11.2
0.7	-40.3	11.2
1	-40.1	11.4
2	-40	11.5
3	-40	11.5
4	-40.1	11.4
5	-40.2	11.3
6	-40.4	11.1
7	-40.4	11.1
8	-40.4	11.1
9	-40.5	11
10	-40.5	11
20	-41.5	10
30	-43.5	8



9.4 Correction factors for biconical antenna – ITL # 1356

Frequency [MHz]	ITL 1356 AF [dB/m]
30	13.00
35	10.89
40	10.59
45	10.63
50	10.12
60	9.26
70	7.74
80	6.63
90	8.23
100	11.12
120	13.16
140	13.07
160	14.80
180	16.95
200	17.17



9.5 Correction factors for log periodic antenna – ITL # 1349

Frequency [MHz]	ITL 1349 AF [dB/m]
200	11.58
250	12.04
300	14.76
400	15.55
500	17.85
600	18.66
700	20.87
800	21.15
900	22.32
1000	24.22

**9.6 Correction factors for
Horn ANTENNA**

**Double –Ridged Waveguide
ITL # 1352**

FREQUENCY	AFE	FREQUENCY	AFE
(GHz)	(dB/m)	(GHz)	(dB/m)
0.75	25	9.5	38
1.0	23.5	10.0	38.5
1.5	26.0	10.5	38.5
2.0	29.0	11.0	38.5
2.5	27.5	11.5	38.5
3.0	30.0	12.0	38.0
3.5	31.5	12.5	38.5
4.0	32.5	13.0	40.0
4.5	32.5	13.5	41.0
5.0	33.0	14.0	40.0
5.5	35.0	14.5	39.0
6.0	36.5	15.0	38.0
6.5	36.5	15.5	37.5
7.0	37.5	16.0	37.5
7.5	37.5	16.5	39.0
8.0	37.5	17.0	40.0
8.5	38.0	17.5	42.0
9.0	37.5	18.0	42.5



9.7 Correction factors for Horn Antenna

**Model: SWH-28
at 3 meter range.
ITL #:1353**

CALIBRATION DATA

3 m distance

Frequency, MHz	Measured antenna factor, dB/m ¹⁾
18000	32.4
18500	32.0
19000	32.3
19500	32.4
20000	32.3
20500	32.8
21000	32.8
21500	32.7
22000	33.1
22500	33.0
23000	33.1
23500	33.8
24000	33.5
24500	33.5
25000	33.8
25500	33.9
26000	34.2
26500	34.7

¹⁾ The antenna factor shall be added to receiver reading in dB μ V to obtain field strength in dB μ V/m.