EMI – TEST REPORT

- FCC 15.231, RSS210 -

Type / Model Name	:	MultiTel 2-915
Product Description	:	Radio transceiver
Applicant	:	elero GmbH
Address	:	Maybachstraße 30
		73278 Schlierbach
		GERMANY
Manufacturer	:	elero GmbH
Address	:	Maybachstraße 30
		73278 Schlierbach
		GERMANY

Test Result according to the standards listed in clause 1 test standards:	**POSITIVE**

Test Report No. : T41253-00-03JP	19. November 2018 Date of issue

Deutsche Akkreditierungsstelle
D-PL-12030-01-01
D-PL-12030-01-02

The test report merely corresponds to the test sample. It is not permitted to copy extracts of these test results without the written permission of the test laboratory.

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1 TEST STANDARDS

The tests were performed according to following standards:

FCC Rules and Regulations Part 15, Subpart A - General (June 2018)

FCC Rules and Regulations Part 15, Subpart C - Intentional Radiators (June 2018)

- Part 15, Subpart C, Section 15.209 Radiated emission limits, general requirements
- Part 15, Subpart C, Section 15.231 Periodic operation in the band 40.66-40.70 MHz and above 70 MHz

RSS-210 Issue 9, August 2016	Spectrum Management and Telecommunications Radio Standards Specifications - Licence-exempt Radio Apparatus: Category I Equipment
RSS-Gen Issue 4, November 2014	Spectrum Management and Telecommunications Radio Standards Specifications - General Requirements and Information for the Certification of Radio Apparatus
ANSI C63.10: 2013	Testing Unlicensed Wireless Devices

2 EQUIPMENT UNDER TEST

2.1 Photo documentation of the EUT

External pictures of EuT:
Refer to document T41253-00-02JP Attachment B
Inhternal pictures of EuT:
Refer to document T41253-00-02JP Attachment C

2.2 Equipment type

Radio transceiver

2.3 Short description of the equipment under test (EUT)

The MultiTel 2 radio transceiver is used together with transceivers connected to tubular or venetian blind motors. The MultiTel 2 transmitter is manually operated by the user and allows the control over the tubular or venetian blind motors.

Number of tested samples: 1
Serial number: 9000160713.51

2.4 Variants of the EUT

none

2.5 Operation frequency

918.3 MHz

2.6 Antenna

Integral antenna

2.7 Transmit operating modes

The equipment under test was operated during the measurement under the following conditions:

- TX mode 918.3 MHz

- RX mode 918.3 MHz

2.8 Power supply system utilised

Power supply voltage, V_{nom} : 3V DC (Battery supplied)

2.9 Peripheral devices and interface cables

The following peripheral devices and interface cables are connected during the measurements:

- none Model :

3 Test result summary

FCC Rule Part	RSS Rule Part	Description	Result
15.207(a)	RSS Gen, 8.8	AC power line conducted emissions	not applicable[1]
15.231(b)	RSS 210, A1.2	Field strength of the fundamental wave	passed
15.209 15.231(b)	RSS Gen, 8.9 RSS 210, A1.2	Spurious emissions radiated	passed
15.35(c)	RSS Gen, 6.10	Duty cycle correction	--
15.231(c)	RSS210, A1.3	20dB and 99% bandwidth	passed
15.231(a)	RSS210, A1.1	Signal deactivation	passed

[1]device is battery supplied

Measurements are made in all three orthogonal axes, reported values are worst coase results.
This test report replaced the report T41253-00-02JP.

3.1 FINAL ASSESSMENT:

The equipment under test fulfills the EMI requirements cited in clause 1 test standards.

Date of receipt of test sample : acc. to storage records

Testing commenced on : 10 April 2017

Testing concluded on : 30 August 2017

Checked by:

Klaus Gegenfurtner
2018.11.20 07:42:33
+01'00'

Klaus Gegenfurtner
Teamleader Radio

Tested by:

Juergen
Pessinger
2018.11.19
09:46:01 +01'00'

Jürgen Pessinger

4 TEST ENVIRONMENT

4.1 Address of the test laboratory

CSA Group Bayern GmbH
Ohmstrasse 1-4
94342 STRASSKIRCHEN
GERMANY

4.2 Environmental conditions

During the measurement, the environmental conditions were within the listed ranges:

Temperature:	15-35 ° C
Humidity:	30-60 %
Atmospheric pressure:	86-106 kPa

4.3 Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. It is noted that the expanded measurement uncertainty corresponds to the measurement results from the standard measurement uncertainty multiplied by the coverage factor k = 2. The true value is located in the corresponding interval with a probability of 95 % The measurement uncertainty was calculated for all measurements listed in this test report acc. to CISPR 16-4-2 / 11.2003 „Uncertainties, statistics and limit modelling – Uncertainty in EMC measurements“ and is documented in the quality system acc. to DIN EN ISO/IEC 17025. For all measurements shown in this report, the measurement uncertainty of the test laboratory, CSA Group Bayern GmbH, is below the measurement uncertainty as defined by CISPR. Therefore, no special measures must be taken into consideration with regard to the limits according to CISPR. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Measurement Type	**Range**	**Confidence Level (%)**	**Calculated Uncertainty**
AC Conducted Spurious Emissions	0.15 MHz to 30 MHz	95%	± 3.29 dB
20 dB Bandwidth	Center frequency of EuT	95%	$\pm 2.5 \times 10^{-7}$
99% Occupied Bandwidth	Center frequency of EuT	95%	$\pm 2.5 \times 10^{-7}$
Radiated Spurious Emissions	9 kHz to 30 MHz	95%	± 3.53 dB
Radiated Spurious Emissions	30 MHz to 1000 MHz	95%	± 3.71 dB
Radiated Spurious Emissions	1000 MHz to 10000 MHz	95%	± 2.34 dB
Peak conducted output power	Center frequency of EuT	95%	± 3.53 dB
Conducted Spurious Emissions	9 kHz to 10000 MHz	95%	± 2.15 dB

4.4 Measurement Protocol for FCC an ISED

4.4.1 General information

4.4.1.1 Test methodology

Conducted and radiated disturbance testing is performed according to the procedures set out in ANSI C63.10 as shown under section 1 of this report.

The Open Area test site is a listed Open Site under the Canadian Test-Sites File-No:

IC 3009A-3

The anechoic chamber site is a listed chamber under the Canadian Test-Sites File-No:

IC 3009A-2

4.4.1.2 Justification

The equipment under test (EUT) is configured in a typical user arrangement in accordance with the manufacturer's instructions. A cable is connected to each available port and either terminated with a peripheral using the appropriate impedance characteristic or left unterminated. Where appropriate, cables are manually manipulated with respect to each other thus obtaining maximum disturbances from the unit.

4.4.1.3 Details of test procedures

The test methods used comply with ANSI C63.10 - "Testing Unlicensed Wireless Devices

Example of value calculation:

Frequency (MHz)	Reading (dBµV)	+	Correction (dB)	=	Level (dBµV/m)	-	Limit (dBµV/m)	=	Delta (dB)
719.0	75.0	+	32.6	=	107.6	-	110.0	=	-2.4

5 TEST RESULTS

5.1 Field strength of the fundamental wave

For test instruments and accessories used see section 6 Part **CPR 2**.

5.1.1 Description of the test location

Test location: OATS 3

Test distance: 3 m

5.1.2 Photo documentation of the test set-up

Refer to document T41253-00-02JP Attachment A

5.1.1 Applicable standard

According to FCC Part 15.231(b) and RSS 210, A1.2

EMI test receiver settings:
30 MHz – 1000 MHz: RBW: 120 kHz

5.1.2 Test result

PK Values

Frequency (MHz)	Reading PK Vert. (dBµV)	Reading PK Hor. (dBµV)	Correct. Vert. (dB)	Correct. Hor. (dB)	Level PK Vert. (dBµV/m)	Level PK Hor. (dBµV/m)	Limit PK (dBµV/m)	Dlimit (dB)
918,30	67,5	59,8	27,0	27,0	94,5	86,8	101,9	-7,4

Corrected AV values

Frequency (MHz)	Level PK Vert. (dBµV/m)	Level PK Hor. (dBµV/m)	DC Correct.* (dB)	DC Correct.* (dB)	Level AV Vert. (dBµV/m)	Level AV Hor. (dBµV/m)	Limit PK (dBµV/m)	Dlimit (dB)
918,30	94,5	86,8	-22,0	-22,0	72,5	64,8	81,9	-9,4

*refer to clause 5.3 of this report

AV Limit according to FCC Part 15.231(b) and RSS 210, A1.2:

Frequency	Field strength of fundamental @ 3m	
(MHz)	(µV/m)	dB(µV/m)
40.66 – 40.70	2250	67
70 - 130	1250	62
130 - 174	1250 to 3750*	62 to 71.4*
174 - 260	3750	71.4
260 - 470	3750 to 12500*	71.4 to 81.9*
Above 470	12500	81.9

*Linear interpolation

The requirements are **FULFILLED.**

Remarks: Measurement was performed with unmodulated signal.

5.2 Spurious emissions radiated

For test instruments and accessories used see section 6 Part **SER 1, SER 2, SER 3**.

5.2.1 Description of the test location

Test location: OATS 3
Test location: Anechoic chamber 1

Test distance: 3 m

5.2.2 Photo documentation of the test set-up

Refer to document T41253-00-02JP Attachment A

5.2.3 Applicable standard

According to FCC Part 15.209 and RSS Gen, 8.9

Instrument settings:
9 kHz – 150 kHz: RBW: 200 Hz
150 kHz – 30 MHz: RBW: 9 kHz
30 MHz – 1000 MHz: RBW: 120 kHz
1000 MHz – 10000 MHz RBW: 1 MHz

5.2.4 Test result f < 30 MHz

TX and RX mode 918.3MHz

Frequency (MHz)	Level QP (dBµV)	Correct. factor (dB)	Corrected level QP dB(µV/m)	AV limit* dB(µV/m)	Delta (dB)
0,536	24,1	20,1	44,2	73,0	-28,8
1,073	23,4	20,3	43,7	67,0	-23,3
1,342	21,6	20,4	42,0	65,0	-23,0

*limit corrected to 3m distance
Remark: No unwanted emissions from the EuT could be detected, noted levels are ambient noise

5.2.5 Test result 30 MHz < f < 1 GHz

TX and RX mode 918.3MHz

Frequency (MHz)	Reading Vert. (dBµV)	Reading Hor. (dBµV)	Correct. Vert. (dB)	Correct. Hor. (dB)	Level Vert. (dBµV/m)	Level Hor. (dBµV/m)	Limit (dBµV/m)	Dlimit (dB)
50,00	4,1	4,1	15,3	15,3	19,4	19,4	61,9	-42,5
250,00	4,9	4,9	15,2	15,2	20,1	20,1	46,0	-25,9
500,00	6,1	6,6	21,3	21,3	27,4	27,9	61,9	-34,0

Remark: No unwanted emissions from the EuT could be detected, noted levels are ambient noise

5.2.6 Test result 1GHz < f < 10 GHz

TX mode 918.3MHz

Frequency (MHz)	Reading PK Vert. (dBµV)	Reading PK Hor. (dBµV)	Correct. Vert. (dB)	Correct. Hor. (dB)	Level PK Vert. (dBµV/m)	Level PK Hor. (dBµV/m)	AV Limit (dBµV/m)	Dlimit (dB)
1836,60	65,5	66,1	-17,1	-17,1	48,4	49,0	54,0	-5,0
1996,00	55,8	61,9	-15,6	-15,6	40,2	46,3	54,0	-7,7
2038,00	55,7	56,3	-15,6	-15,6	40,1	40,7	54,0	-13,3
3673,20	55,4	56,9	-12,8	-12,8	42,7	44,1	54,0	-9,9
4591,50	44,7	43,2	2,1	2,1	46,8	45,3	54,0	-7,2
5509,80	46,5	47,2	4,3	4,3	50,8	51,5	54,0	-2,5
6428,10	43,7	47,1	6,4	6,4	50,1	53,5	54,0	-0,5
7346,40	--	41,6	--	7,0	--	48,6	54,0	-5,4
8264,70	40,4	39,8	7,0	7,0	47,4	46,8	54,0	-6,6
9183,00	43,3	43,4	7,3	7,3	50,6	50,7	54,0	-3,3

RX mode 918.3MHz

Frequency (MHz)	Reading PK Vert. (dBµV)	Reading PK Hor. (dBµV)	Correct. Vert. (dB)	Correct. Hor. (dB)	Level PK Vert. (dBµV/m)	Level PK Hor. (dBµV/m)	AV Limit (dBµV/m)	Dlimit (dB)
1330,00	--	59,4	--	-19,6	--	39,8	54,0	-14,2
1996,00	58,6	--	-15,6	--	43,0	--	54,0	-11,0
4192,00	41,9	40,3	0,8	0,8	42,7	41,1	54,0	-11,3

Limit according to FCC Section 15.209 and RSS Gen, 8.9:

Frequency	Field strength of spurious emissions		Measurement distance
(MHz)	(µV/m)	dB(µV/m)	(metres)
0.009-0.490	2400/F(kHz)	--	300
0.490-1.705	24000/F (kHz)	--	30
1.705-30.0	30	29.5	30

Frequency (MHz)	15.209 Limits (µV/m)	15.209 Limits dB(µV/m)
30 - 88	100	40
88 - 216	150	43,5
216 - 960	200	46
Above 960	500	54

The requirements are **FULFILLED.**

Remarks: The measurement is performed up to the 10th harmonic.

Measurement was performed with unmodulated signal.

5.3 Duty cycle correction

For test instruments and accessories used see section 6 Part **DC**.

5.3.1 Description of the test location

Test location: Shielded Room S4

5.3.2 Photo documentation of the test set-up

Refer to document T41253-00-02JP Attachment A

5.3.3 Applicable standard

According to FCC Part 15.35(c) and RSS Gen, 6.10:

5.3.4 Description of Measurement

The Duty cycle factor (dB) is calculated applying the following formula:

$$K_E = 20 \log (t_{iB}/T_w)$$

K_E:	pulse operation correction factor	(dB)
t_{iB}	on time	(ms)
T_w	a period of the pulse track or 100ms whichever is shorter	(ms)

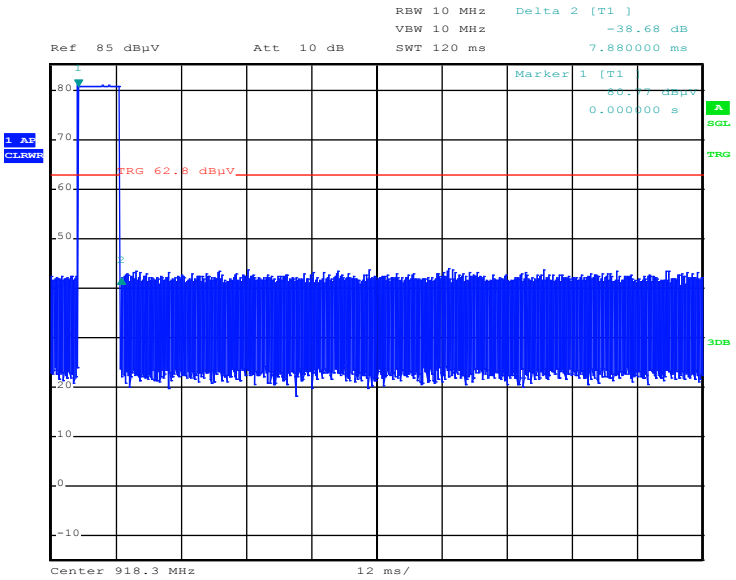
5.3.5 Test result

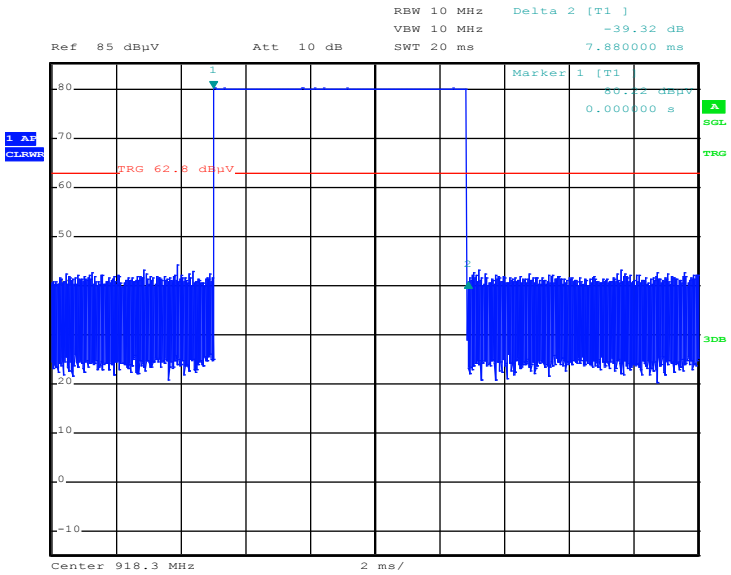
T_w (ms)	t_{iB} (ms)	K_E (dB)
100	7,88	-22,0

Remarks: The pulse train (*Tw*) exceeds 100 ms, therefore the duty cycle has been calculated by using 100ms. Used values indicates the worst case.

For detailed test results please see the following test protocols.

5.3.6 Test protocol





5.4 Emission bandwidth

For test instruments and accessories used see section 6 Part **MB**.

5.4.1 Description of the test location

Test location: AREA4

5.4.2 Photo documentation of the test set-up

Refer to document T41253-00-02JP Attachment A

5.4.3 Applicable standard

According to FCC Part 15.231(c) and RSS 210, A1.3

Analyser settings:
Span: 500 kHz, RBW: 3 kHz VBW: 10 kHz Detector: peak;

5.4.4 Test result

Fundamental [MHz]	20dB Bandwidth [MHz]	99% Bandwidth [MHz]	Limit [MHz]	Result
918.3	0.129	0.124	4.59	PASS

Limit according to FCC Part 15C Section 15.231(c) and RSS-210, A1.3:

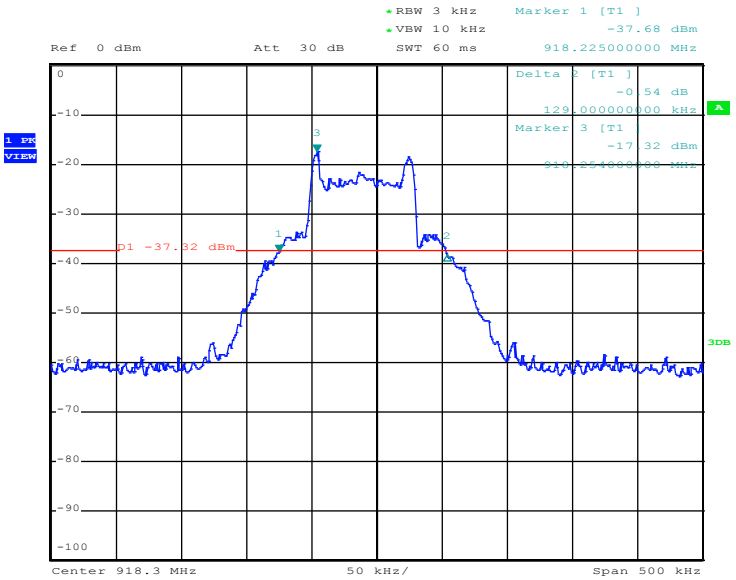
Frequency (MHz)	20 dB BW limit dependent of the carrier (%)
70 – 900	0.25
above 900	0.50

The requirements are **FULFILLED.**

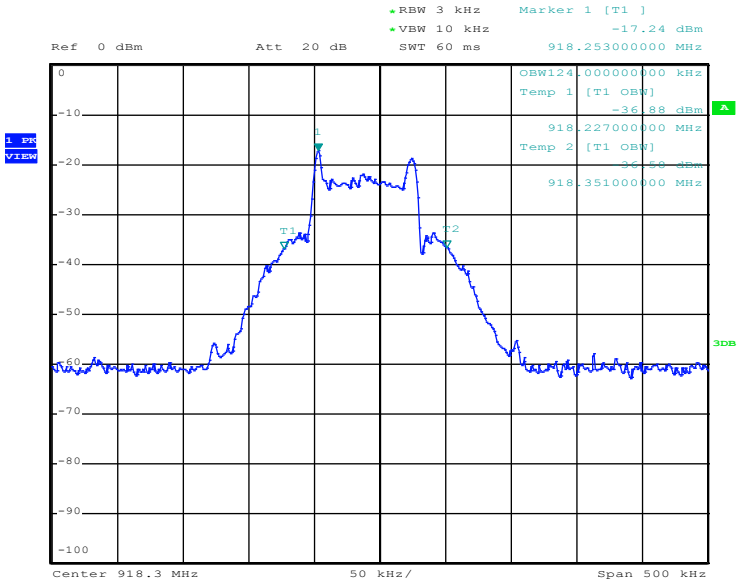
Remarks: For detailed test results please see the following test protocols.

5.4.5 Test protocol

20dB Bandwidth



99 Bandwidth



5.5 Signal deactivation

For test instruments and accessories used see section 6 Part **DC**.

5.5.1 Description of the test location

Test location: AREA4

5.5.2 Photo documentation of the test set-up

Refer to document T41253-00-02JP Attachment A

5.5.3 Applicable standard

According to FCC Part 15.231(a) and RSS 210, A1.1

5.5.4 Test result

Duration of transmission (ms)	Duration after releasing the button (ms)
7.88	Last transmission package was sent 1.935s after releasing the the button.

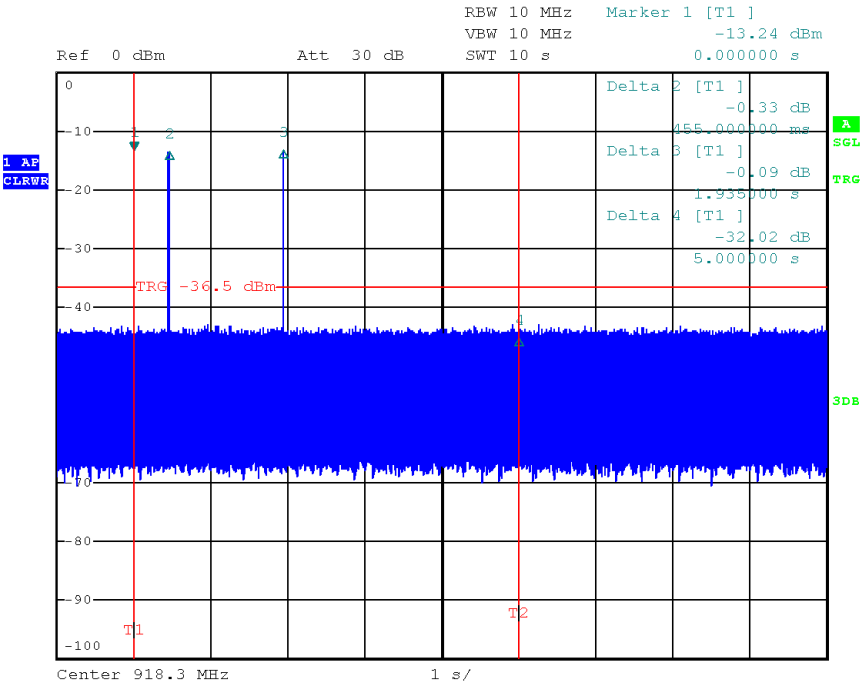
Limit according to FCC Part 15C, Section 15.231(a) and RSS 210, A1.1:
A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released and a transmitter activated automatically shall cease transmission within 5 seconds after activation.

The requirements are **FULFILLED.**

Remarks: For detailed test results please see the following test protocol.

5.5.5 Test protocol

918.3 MHz



Marker 1 indicates the reslease of the TX button

6 USED TEST EQUIPMENT AND ACCESSORIES

All test instruments used are calibrated and verified regularly. The calibration history is available on request.

Test ID	Model Type	Equipment No.	Next Calib.	Last Calib.	Next Verif.	Last Verif.
CPR 2	ESPI 3	01-02/03-03-004	02/10/2018	02/10/2017		
	VULB 9163	01-02/24-01-006	19/10/2018	19/10/2017		
	N-40000-N	01-02/50-05-043				
	N-30000-N	01-02/50-05-044				
DC	FSP 30	02-02/11-05-001	04/10/2018	04/10/2017		
MB	FSP 30	02-02/11-05-001	04/10/2018	04/10/2017		
SER 1	ESPI 3	01-02/03-03-004	02/10/2018	02/10/2017		
	FMZB 1516	01-02/24-01-018			27/03/2018	27/03/2017
	N-40000-N	01-02/50-05-043				
	N-30000-N	01-02/50-05-044				
SER 2	ESPI 3	01-02/03-03-004	02/10/2018	02/10/2017		
	VULB 9163	01-02/24-01-006	19/10/2018	19/10/2017		
	N-40000-N	01-02/50-05-043				
	N-30000-N	01-02/50-05-044				
SER 3	FSP 30	02-02/11-05-001	04/10/2018	04/10/2017		
	AFS5-12001800-18-10P-6	02-02/17-06-002				
	AFS4-01000400-10-10P-4	02-02/17-13-002				
	AMF-4F-04001200-15-10P	02-02/17-13-003				
	3117	02-02/24-05-009	08/05/2019	08/05/2018		
	Sucoflex N-2000-SMA	02-02/50-05-075				
	SF104/11N/11N/1500MM	02-02/50-13-015				