

EMI – TEST REPORT

- FCC Part 15.407, 5725-5850 MHz -

Type / Model Name : MobilePanel277IWLAN V2 / 277FIWLANV2

Product Description : Mobile Human Machine Interface

Applicant : Siemens AG, DF FA AS DH AMB

Address : Werner-von-Siemens-Str. 50

92224 AMBERG, GERMANY

Manufacturer : Siemens AG, DF FA AS

Address : Gleiwitzer Str. 555

90475 NUERNBERG, GERMANY

Licence holder : Siemens AG, DF FA AS DH AMB

Address : Werner-von-Siemens-Str. 50

92224 AMBERG, GERMANY

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

POSITIVE

Test Report No. : **T34492-17-00HS**

01. June 2016

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.

Contents

1	<u>TEST STANDARDS</u>	3
2	<u>EQUIPMENT UNDER TEST</u>	4
2.1	Photo documentation of the EUT – Detailed photos see ATTACHMENT A	4
3	<u>TEST RESULT SUMMERY</u>	7
3.1	Final assessment	7
4	<u>TEST ENVIRONMENT</u>	8
4.1	Address of the test laboratory	8
4.2	Environmental conditions	8
4.3	Statement of the measurement uncertainty	8
4.1	Measurement protocol for FCC and ISED	9
5	<u>TEST CONDITIONS AND RESULTS</u>	10
5.1	AC power line conducted emissions	10
5.2	Emission bandwidth and occupied bandwidth	11
5.3	Maximum conducted output power	15
5.4	Maximum power spectral density	18
5.5	Defacto limit	20
5.6	Unwanted emissions	21
6	<u>USED TEST EQUIPMENT AND ACCESSORIES</u>	24

ATTACHMENT A as separate supplement

1 TEST STANDARDS

The tests were performed according to following standards:

FCC Rules and Regulations Part 15, Subpart A - General (September 2015)

Part 15, Subpart A, Section 15.31	Measurement standards
Part 15, Subpart A, Section 15.33	Frequency range of radiated measurements
Part 15, Subpart A, Section 15.35	Measurement detector functions and bandwidths

FCC Rules and Regulations Part 15, Subpart C - Intentional Radiators (September 2015)

Part 15, Subpart C, Section 15.203	Antenna requirement
Part 15, Subpart C, Section 15.204	External radio frequency power amplifiers and antenna modifications
Part 15, Subpart C, Section 15.205	Restricted bands of operation
Part 15, Subpart C, Section 15.207	Conducted limits
Part 15, Subpart C, Section 15.209	Radiated emission limits, general requirements
Part 15, Subpart C, Section 15.212	Modular transmitters

FCC Rules and Regulations Part 15, Subpart E – Unlicensed National Information Infrastructure Devices (December 2015)

Part 15, Subpart E, Section 15.407	Operation within the bands 5.15 - 5.25 GHz, 5.25 - 5.35 GHz, 5.47 - 5.725 GHz and 5.725 - 5.85 GHz
Amendment(s) published April 6, 2016, in 81 FR 19901	

ANSI C63.10: 2013	Testing Unlicensed Wireless Devices
ETSI TR 100 028 V1.3.1: 2001-03	Electromagnetic Compatibility and Radio Spectrum Matters (ERM); Uncertainties in the Measurement of Mobile Radio Equipment Characteristics—Part 1 and Part 2
KDB 789033 D02 v01r02	Guidance for compliance Testing of U-NII devices, April 8, 2016.

2 EQUIPMENT UNDER TEST

2.1 Photo documentation of the EUT – Detailed photos see ATTACHMENT A

2.2 General remarks:

The EUT is fully tested and approved according the “old Rules”. This test report shall show the further compliance to the “new Rules” under the premise that no operating parameter of the EUT are changed. Therefore the output power and the PSD are re-measured under the “new rules”. Spurious emissions stay the same as under the “old Rules” and are already documented with the test report T34492-00-01AA by mikes testing partners. The additional requirements of Spourius emissions under the Amendment of FCC 15.407 are measured and are compliant to the “new rules”.

2.3 Equipment category

WLAN - Client

2.4 Short description of the equipment under test (EUT)

The EUT consists of 1 WLAN Module and 1 Effective Range Module (Chirp 2.45 GHz) which measure the distance between Mobile Panel and accompanying Transponder.
The Mobile Panel 277 IWLAN V2/ 277F IWLAN V2 permits mobile operation at any point in the system. The HMI device communicates with the PLC via WLAN. The HMI device is equipped with a zone recognition function. The operator can operate the system wireless at almost any location on the machine or system.

Number of tested samples: 1
Serial number WLAN-Module: SVP D8006322
Firmware version mobile panel: V02.00.00.00_01.01.00.10

EUT configuration:

(The CDF filled by the applicant can be viewed at the test laboratory.)

2.5 Variants of the EUT

Variant	Device-Name	WLAN interface	Authetification interface	Antenna port	Safety button	Order number
1	Mobile panel 277 IWLAN V2	1	WBM	-	-	6AV6645-0FD01-0AX1
2	Mobile panel 277 IWLAN V2	1	WBM	-	-	6AV6645-0FE01-0AX1
3	Mobile panel 277F IWLAN V2	1	WBM	-	Yes	6AV6645-0GB01-0AX1
4	Mobile panel 277F IWLAN V2	1	WBM	-	Yes	6AV6645-0GC01-0AX1

The mobile panel 277F IWLAN offers the possibility of having the mobile safety functions of emergency stop available at any point of a machine or plant. The 277 IWLAN does not have the safety function. Both are electronically identical however, the 277 IWLAN is not equipped with the relevant parts necessary for the safety function.

2.6 Operation frequency and channel plan

The operating frequency is 5725 MHz to 5850 MHz.

Channel plan:

Channel plan WLAN Standard 802.11a:

Channel	Frequency
149	5745
153	5765
157	5785
161	5805
165	5825

Note: The marked frequencies are determined for final testing.

2.7 Transmit operating modes

The module use OFDM modulation and is capable to provide following data rates:

- 802.11a 54, 48, 36, 24, 18, 12, 9, 6 Mbps

2.8 Antenna

The EUT is equipped with 2 internal WLAN antennas E148 (peak gain= 5 dBi at 5 GHz) and 1 dual port patch antenna (gain=2.6 / 2.7 dBi).

2.9 Power supply system utilised

Power supply voltage : 7.2 V DC Battery
Power supply voltage (alternative) : Input: 110-240 V / 47-63 Hz / 1 ϕ Power supply
Output: +12 V DC

2.10 Peripheral devices and interface cables

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

- - Model : -

- - Model : -

- - Model : -

2.11 Determination of worst case conditions for final measurement

Measurements are made in all three orthogonal axes and the settings of the EUT are changed to locate at which position and at what setting of the EUT produce the maximum of the emissions. All tests are carried out with the full equipped 277F IWLAN Mobile Panel. The tests are carried out in the following frequency band:

5725 - 5850 MHz

Preliminary tests are performed to find the worst-case mode from all possible combinations between available modulations and data rates. The maximum output power depends on used data rate. The EUT is controlled for several tests with special test software used for testing only where continuous signals are needed. For the tests a max possible duty cycle (x) is set.

Following channels and test modes are selected for the final test as listed below:

WLAN	Available channel	Tested channels	Power setting	Modulation	Modulation type	Data rate
802.11a	149 to 165	149, 157, 165	P14	OFDM	BPSK	6 Mbps

- TX continuous mode, 802.11a

2.11.1 Test jig

As test jig, the host of an access point (LAP) is used where the WLAN-module can be plugged in. The host supplies all need interface connections needed for test operation and control. Conducted measurements are performed using the test jig.

Radiated measurements have been performed with normal configuration of the MP (WLAN-module inside).

2.11.2 Test software

Test software is used to set TX continuous in device service mode. Power, channel and modulation (data rate) setting is done via network interface which is available for professional settings. The power setting is done by the web interface of the test jig.

3 TEST RESULT SUMMERY

UNII device using the operating band 5725 MHz – 5850 MHz:

FCC Rule Part (new rules)	FCC Rule Part (old rules)	Description	Result
15.407(b)(6)	15.207(a)	AC power line conducted emissions	Not tested
15.407(e)	15.247(a)(2)	6 dB EBW	passed
15.407(a)(3)	15.247(b)(3)	Maximum conducted output power	passed
15.407(b)(4)	15.247(d)	Unwanted emission, radiated	Not tested
15.407(b)(7)	15.247(d)	Unwanted emissions in restricted bands	Not tested
15.407(a)(3)	15.247(e)	Maximum power spectral density	passed
15.35(c)	15.35(c)	Pulsed operation	Not tested
15.203	15.247(b)(4)	Antenna requirement	passed
15.407(g)	-	Transmitter frequency stability	Not tested
KDB 789033	-	99 % Bandwidth	passed

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 : 29 April 2016

Testing concluded on : 05 May 2016

Checked by:

Tested by:

Klaus Gegenfurtner
Teamleader Radio

Hermann Smetana
Radio Team

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. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. to CISPR 16-4-2 „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, mikes-testingpartners 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 uncertainty table

Measurement output power, conducted	±1.5 dB
Measurement PSD, conducted	±1.5 dB
Measurement spurious emissions, conducted	±3.0 dB
Measurement spurious emissions, radiated	±6.0 dB
Measurement frequency	±1 x 10 ⁻⁶

4.1 Measurement protocol for FCC

4.1.1 General information

4.1.1.1 Test methodology

Conducted and radiated disturbance testing is performed according to the procedures set out by the International Special Committee on Radio Interference (CISPR) Publication 22, European Standard EN 55022 as shown under section 1 of this report.

4.1.1.2 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 without termination. Where appropriate, cables are manually manipulated with respect to each other thus obtaining maximum disturbances from the unit.

4.1.1.3 Details of test procedures

The test methods used comply with CISPR Publication 22, EN 55022 - "Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement" and with ANSI C63.10 - "Testing Unlicensed Wireless Devices". In compliance with 47 CFR Part 15 Subpart A, Section 15.38 testing for FCC compliance may be achieved by following the procedures set out in ANSI C63.10 and applying the CISPR 22 limits.

5 TEST CONDITIONS AND RESULTS

5.1 AC power line conducted emissions

For test instruments and accessories used see section 6 Part A 4.

5.1.1 Description of the test location

Test location: NONE

Remarks: This measurement is already documented in the test report T34492-00-01AA.

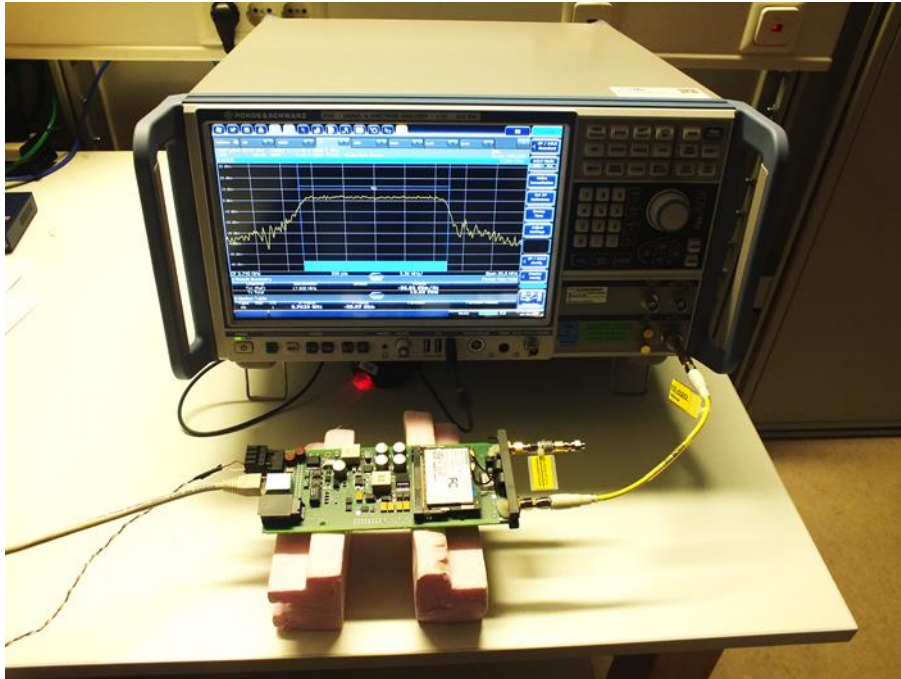
5.2 Emission bandwidth and occupied bandwidth

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

5.2.1 Description of the test location

Test location: AREA4

5.2.2 Photo documentation of the test set-up



5.2.3 Applicable standard

According to FCC Part 15, Section 15.407(e):

Within the 5.725-5.85 GHz band, the minimum 6 dB bandwidth of U-NII devices shall be at least 500 kHz.

5.2.4 Description of Measurement

The minimum 6 dB bandwidth is measured conducted using a spectrum analyser with n-dB down function if applicable otherwise the 6 dB bandwidth is measured manually and following the procedure set out in ANSI C63.10, item 6.9.2 or KDB 789033 D02, item C.2. The bandwidth is measured at Port 1.

Spectrum analyser settings 6 dB bandwidth:

RBW: 100 kHz, VBW: 300 kHz, Detector: Peak, Trace mode: max hold;

Spectrum analyser settings occupied bandwidth:

For 20 MHz channels:
RBW: 300 kHz, VBW: 1 MHz, Detector: Peak, Trace mode: max hold;

5.2.5 Test result

802.11a mode, Port1:

Channel	Centre frequency	6 dB bandwidth	Minimum 6 dB limit	99% OBW	26 dB bandwidth
	(MHz)	(MHz)	(MHz)	(MHz)	(MHz)
149	5745	16.333	0.5	17.210	23.410
157	5785	16.320	0.5	17.205	23.070
165	5825	16.332	0.5	17.200	23.380

Note: There is no limit for the EBW 26 dB nor OBW 99 %.

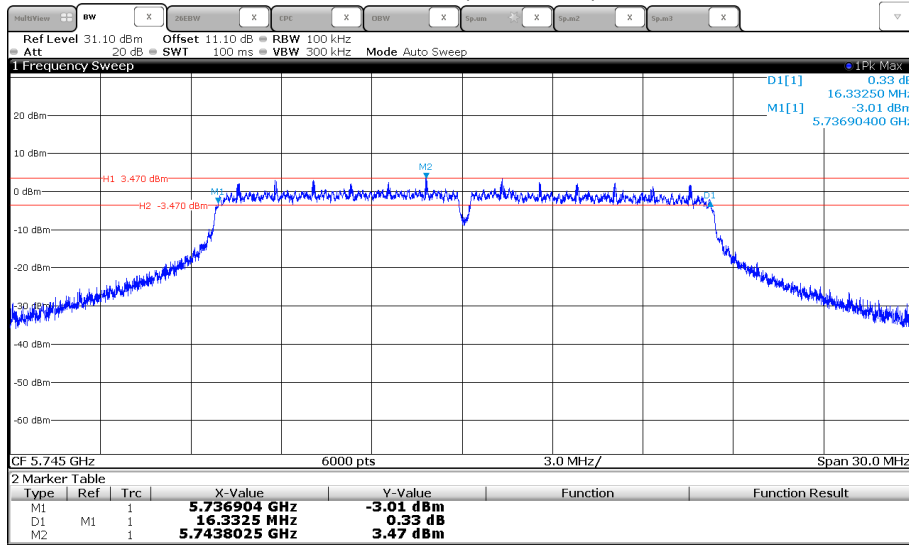
The requirements are **FULFILLED**.

Remarks: For detailed test results please refer to following test protocols.

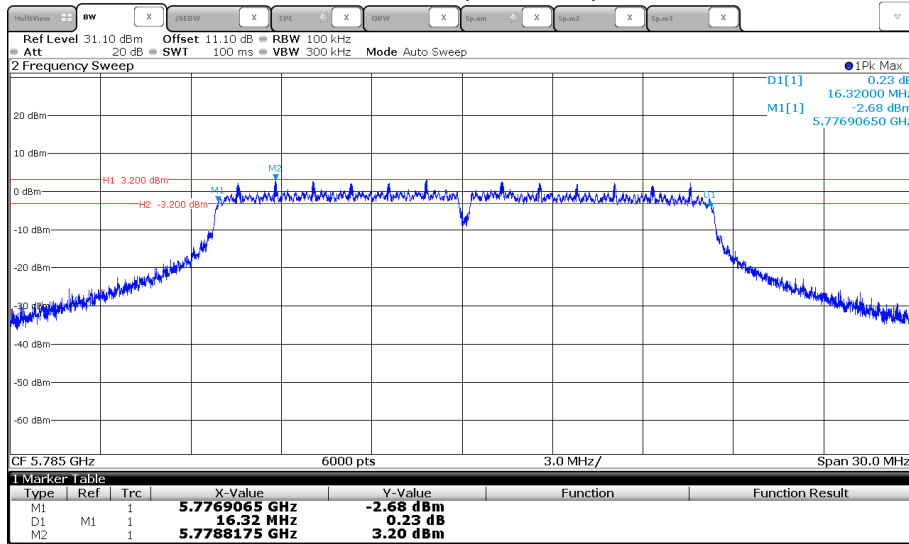
5.2.6 Test protocols emission bandwidth 6 dB

802.11a:

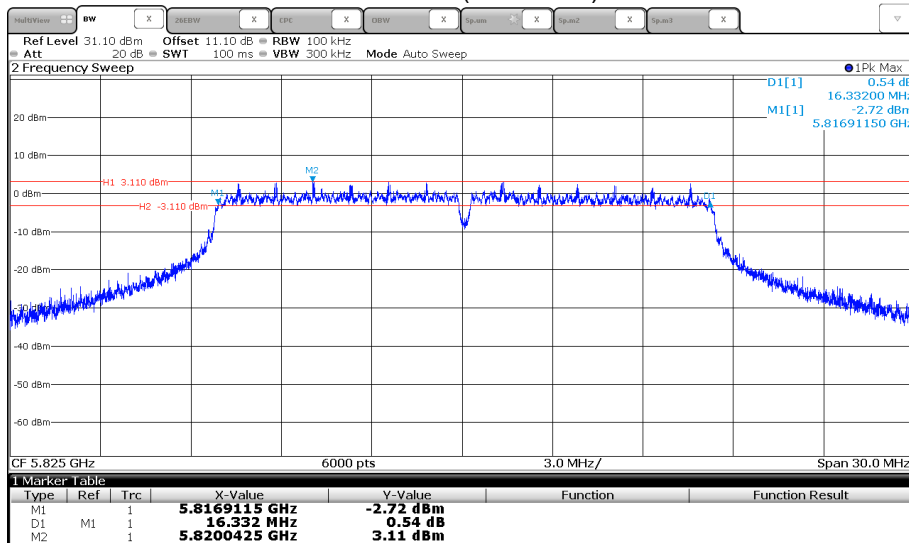
Channel 149 (5745 MHz)



Channel 157 (5785 MHz)



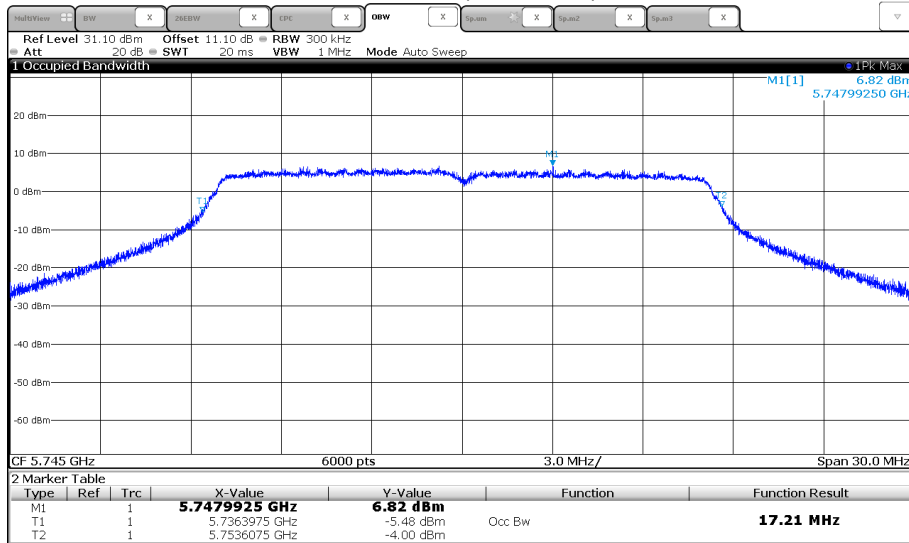
Channel 165 (5825 MHz)



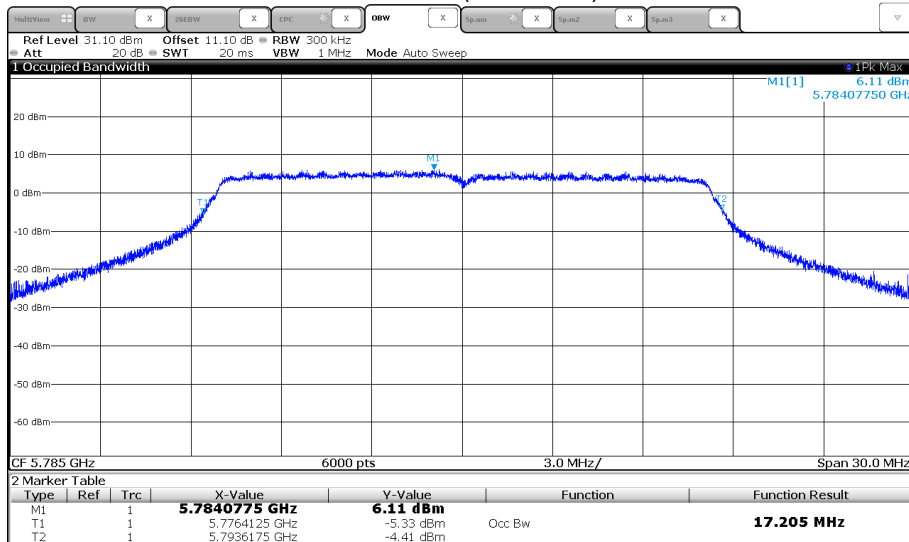
5.2.7 Test protocols OBW 99 %

802.11a:

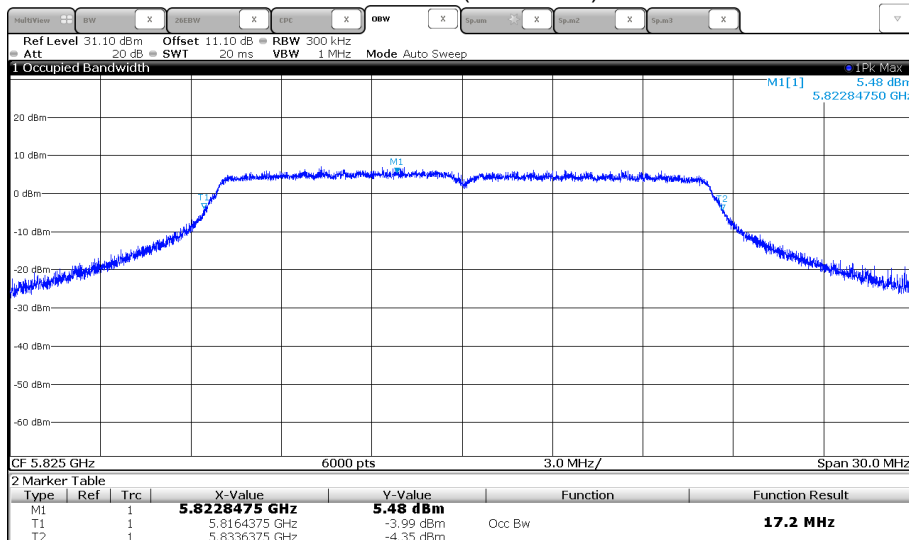
Channel 149 (5745 MHz)



Channel 157 (5785 MHz)



Channel 165 (5825 MHz)



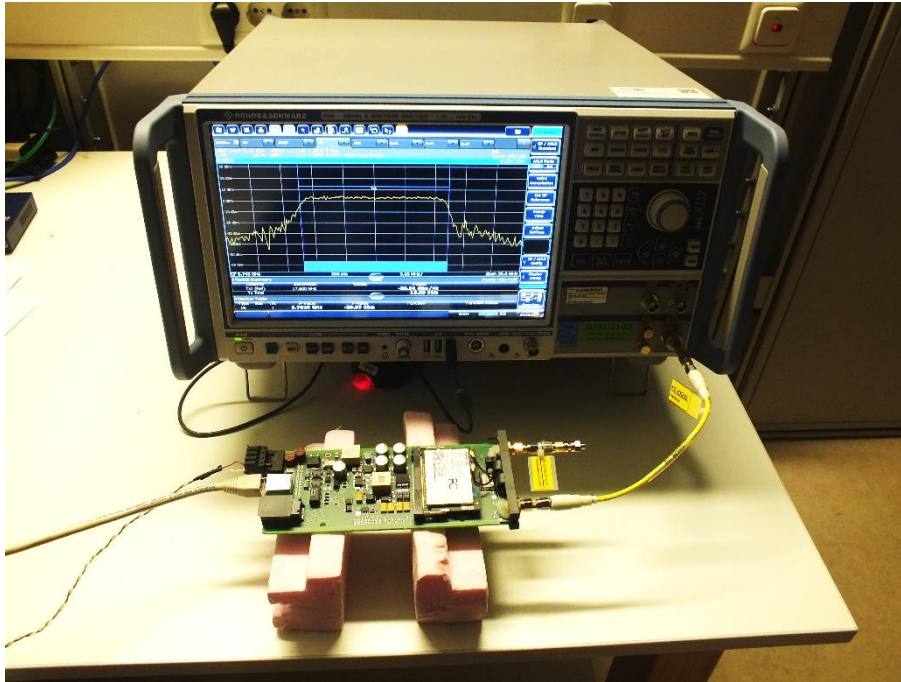
5.3 Maximum conducted output power

For test instruments and accessories used see section 6 Part **CPC 3**.

5.3.1 Description of the test location

Test location: AREA 4

5.3.2 Photo documentation of the test set-up



5.3.3 Applicable standard

According to FCC Part 15, Section 15.407(a)(3):

For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W.

5.3.4 Description of Measurement

The maximum conducted output power is measured using a spectrum analyser with the function “integrated band power measurement” following the procedure set out in KDB 789033 D02, item C f) Method SA-1. The EUT is set in TX continuous mode 99% while measuring. The resulting values are listed in the following tables. An insertion loss of 11.1 dB for measurement cable and 10 dB attenuator is taken into account with amplitude offset.

Spectrum analyser settings:

RBW: 1 MHz,	VBW: 3 MHz,	Detector: RMS (power averaging),	Trace averaging: 100;
Number of points: 200,	Sweep time: auto,	Band power function;	

5.3.5 Test result

Test results								
Channel	P set	Ant gain	A	Limit	Margin	EIRP	Limit	Margin
		(dBi)	(dBm)	(dBm)	(dB)	(dBm)	(dBm)	(dB)
CH149	P14	5	14.9	30.0	-15.1	19.9	36.0	-16.1
CH157	P14	5	14.7	30.0	-15.3	19.7	36.0	-16.3
CH165	P14	5	15.1	30.0	-14.9	20.1	36.0	-15.9

Maximum conducted output power limit according to FCC Part 15, Section 15.407(a)(3):

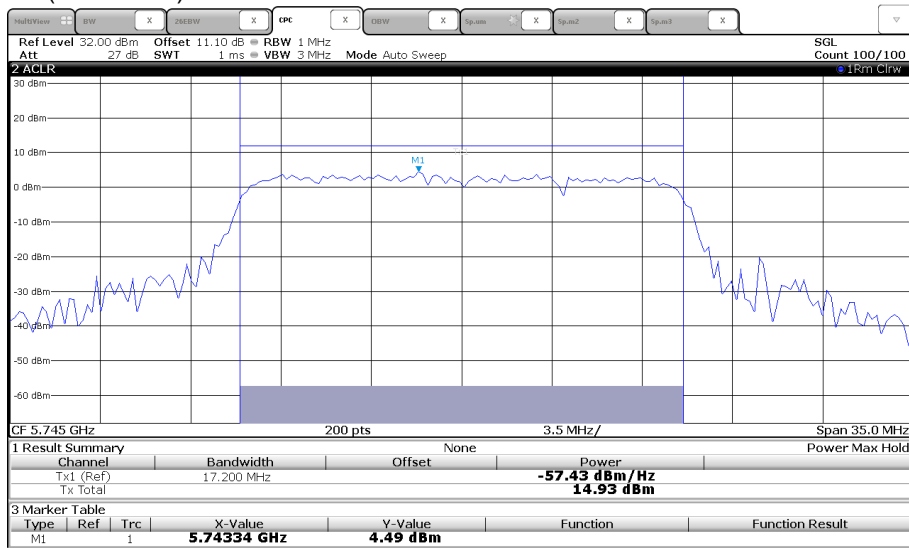
Frequency (MHz)	Maximum conducted power limit	
	(dBm)	(Watt)
5725 - 5850	30	1.0

The requirements are **FULFILLED**.

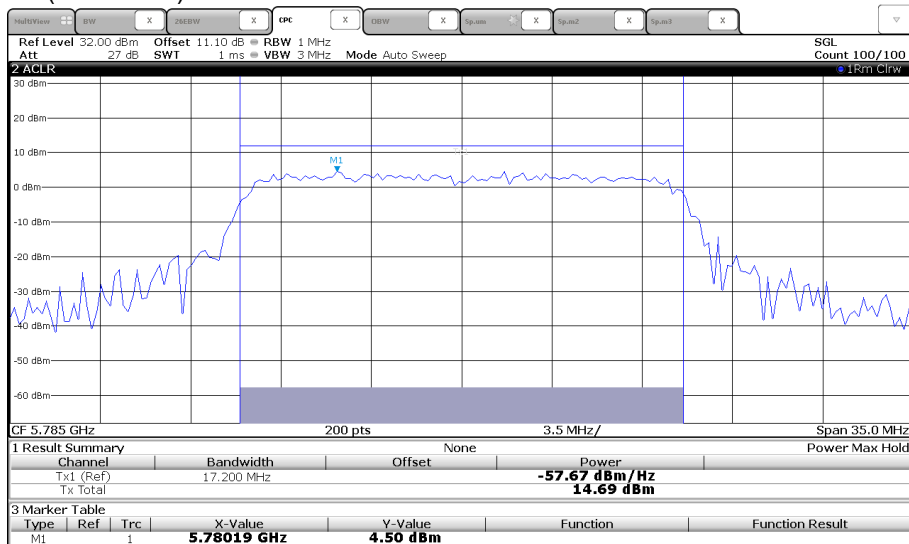
Remarks: For detailed test results please see the following test protocols.

5.3.6 Test protocols

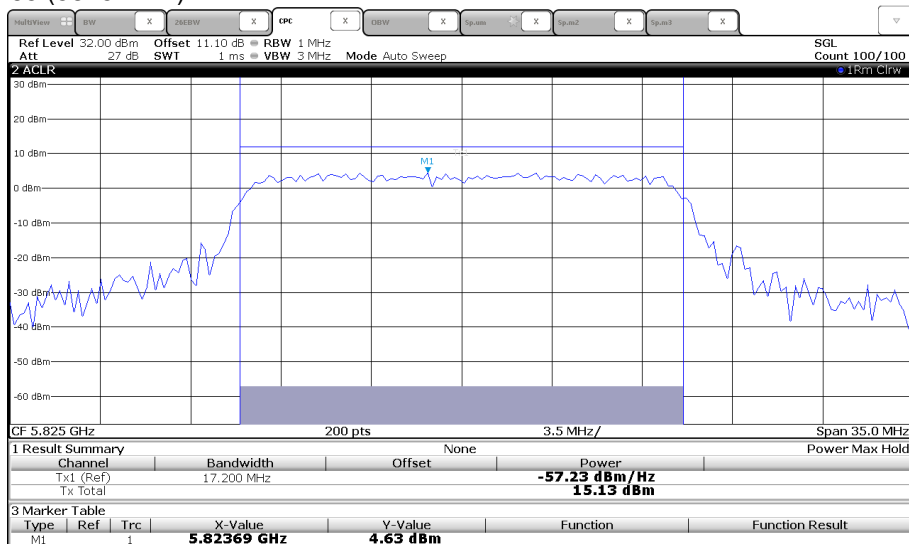
802.11a, Channel 149 (5745 MHz) P14:



802.11a, Channel 157 (5785 MHz) P14:



802.11a, Channel 165 (5825 MHz) P14:



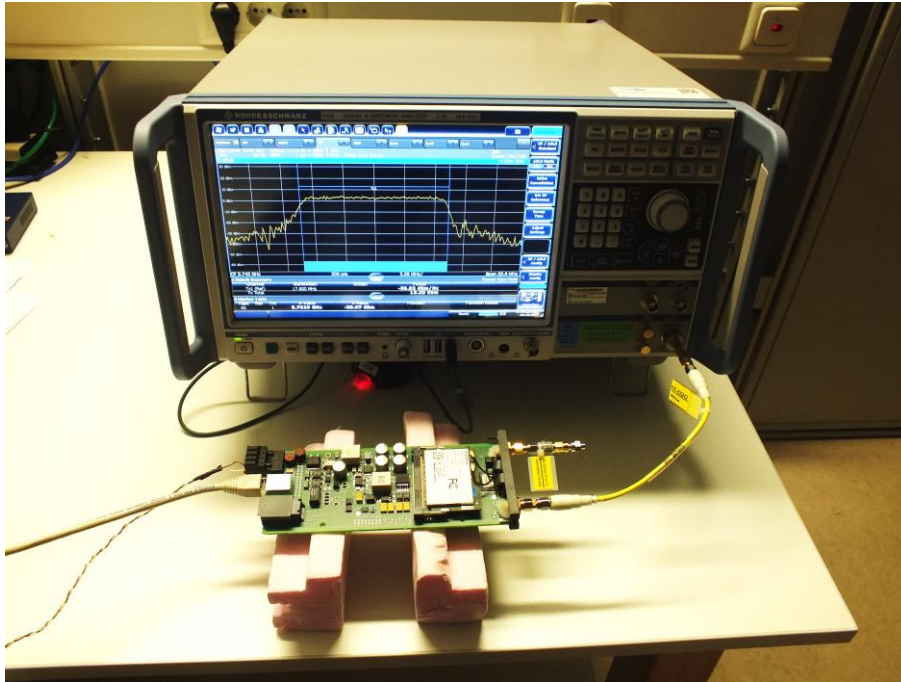
5.4 Maximum power spectral density

For test instruments and accessories used see section 6 Part CPC 3.

5.4.1 Description of the test location

Test location: AREA 4

5.4.2 Photo documentation of the test set-up



5.4.3 Applicable standard

According to FCC Part 15, Section 15.407(e):

The maximum power spectral density shall not exceed 30 dBm in any 500-kHz band.

5.4.4 Description of Measurement

The maximum conducted PSD is measured using a spectrum analyser with the function “integrated band power measurement” following the procedure set out in KDB 789033 D02, item F. Therefore the PSD is measured the same way. The “integrated band power measurement” is related to PSD (dBm/Hz). The EUT is set in TX continuous mode while measuring. The values are corrected with the conversion factor Hz to 500 kHz, 57.0 dB. The resulting values are listed in the following tables. An insertion loss of 11.1 dB for measurement cable and 10 dB attenuator is taken into account with amplitude offset.

Spectrum analyser settings:

RBW: 1 MHz,	VBW: 3 MHz,	Detector: RMS (power averaging),	Trace averaging: 100;
Number of points: 200,	Sweep time: auto,	Band power function;	

5.4.5 Test result

Raw data as representative for all one Port measurements, used for 802.11a:

PD1 [P14]
(dBm/Hz)

CH149	-57.43
-------	--------

CH157	-57.67
-------	--------

CH165	-57.23
-------	--------

Calculation of the total output power:

Test results								
Channel	P set	Ant gain	PSD	Limit	Margin	EIRP PSD	Limit	Margin
		(dBi)	(dBm/500 kHz)	(dBm/500 kHz)	(dB)	(dBm/500 kHz)	(dBm/500 kHz)	(dB)
CH149	P14	5	-0.4	30.0	-30.4	4.6	36.0	-31.4
CH157	P14	5	-0.7	30.0	-30.7	4.3	36.0	-31.7
CH165	P14	5	-0.2	30.0	-30.2	4.8	36.0	-31.2

Power spectral density limit according to FCC Part 15, Section 15.407(e):

The maximum power spectral density shall not exceed 30 dBm in any 500-kHz band.

Frequency (MHz)	Power spectral density limit	
	(dBm/500 kHz)	
5725 - 5850	30	

The requirements are **FULFILLED**.

Remarks: For detailed test results please see the test protocols under 5.3.6.

5.5 Defacto limit

For test instruments and accessories used see section 6 Part **CPC 3**.

5.5.1 Description of the test location

Test location: NONE

Remarks: The used antenna is lower 6 dBi gain, no additional adjustment requires.

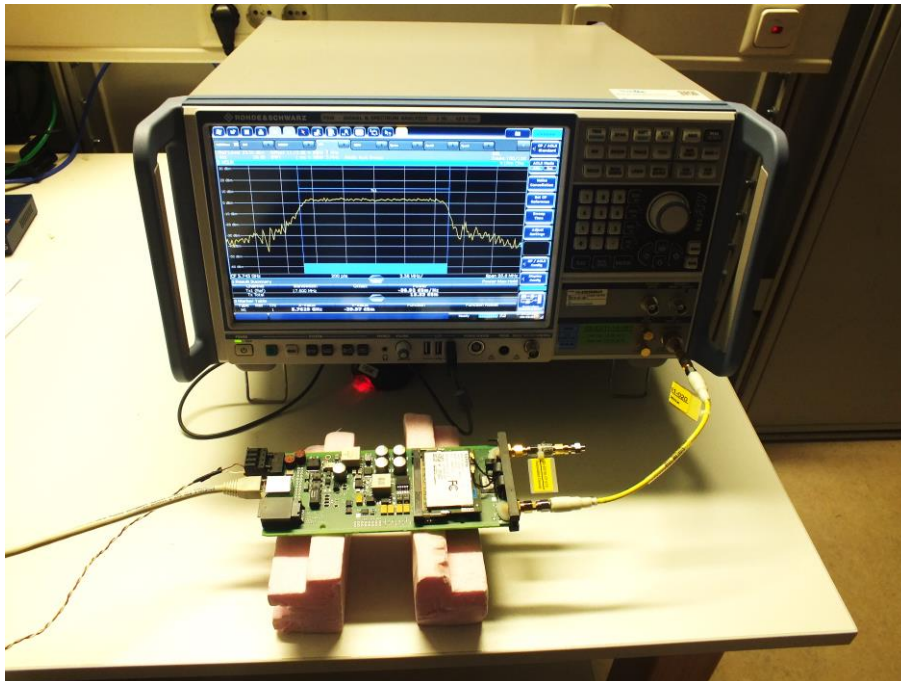
5.6 Undesirable emissions

For test instruments and accessories used see section 6 Part **SEC 3**.

5.6.1 Description of the test location

Test location: AREA4

5.6.2 Photo documentation of the test set-up



5.6.3 Applicable standard

According to FCC Part 15E, Section 15.407(b)(4)(i):

All emissions shall be limited to a level of -27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.

5.6.4 Description of Measurement

Undesirable emissions are measured using a spectrum analyser and following the procedures according the KDB 789033 D02, item G. If the emission level of the EUT in peak mode complies with the average limit then testing will be stopped and peak values of the EUT will be reported, otherwise, the emission will be measured in average mode again and reported.

Spectrum analyser settings for peak values:

RBW: 1 MHz, VBW: 3 MHz, Sweep: Auto, Trace mode: max hold;

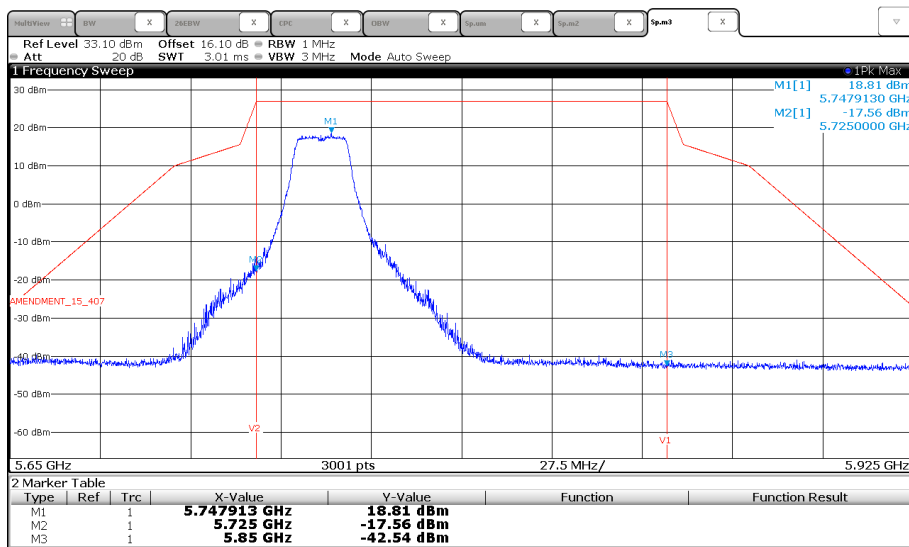
Spectrum analyser settings for average values:

RBW: 1 MHz VBW: 10 Hz Sweep: Auto, Trace mode: max hold;

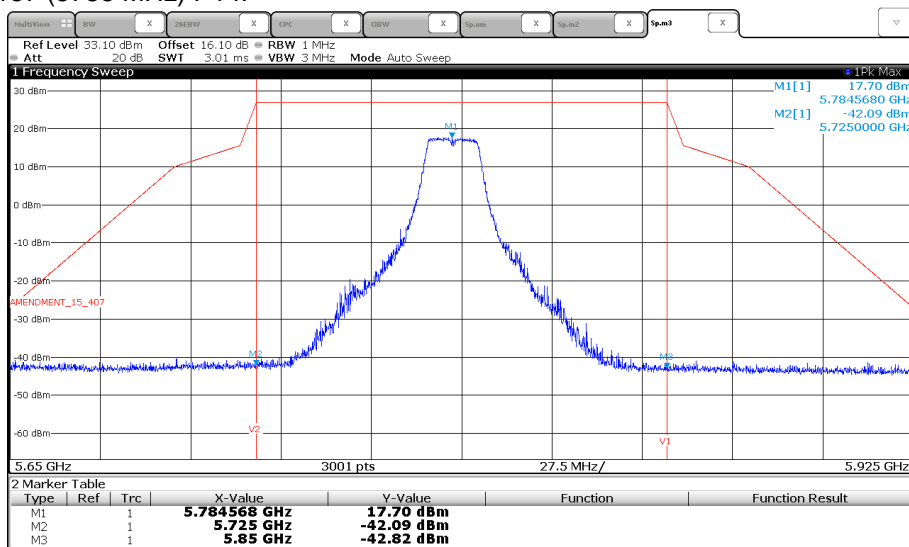
5.6.5 Test result

802.11a, Channel 149 (5745 MHz) P14:

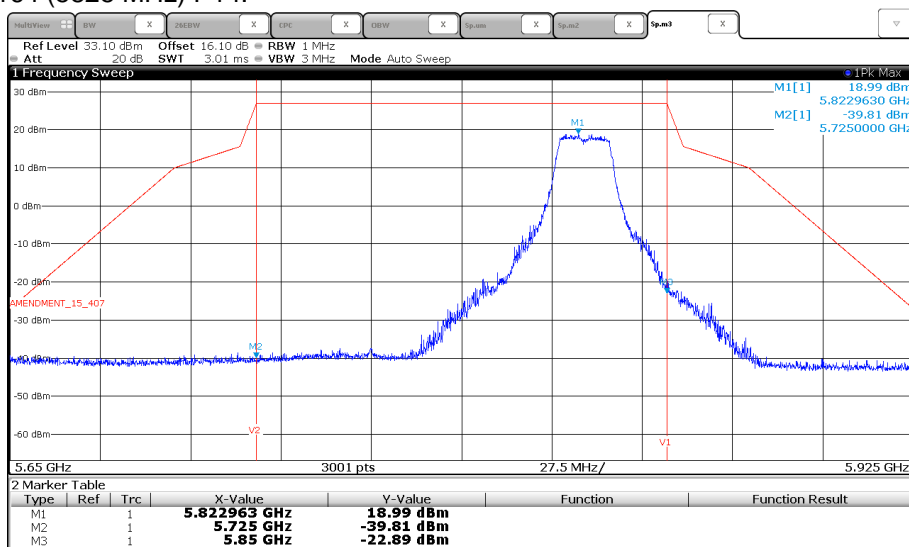
FCC ID: U9A277IWLAN-V210



802.11a, Channel 157 (5785 MHz) P14:



802.11a, Channel 164 (5825 MHz) P14:



Limit according to FCC Part 15E, Section 15.407(b)(4)(i) for undesirable emissions:

FCC ID: U9A277IWLAN-V210

All emissions shall be limited to a level of -27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.

The requirements are **FULFILLED**.

Remarks:

Antenna application**5.6.6 Applicable standard**

According to FCC Part 15C, 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. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit that broken antennas can be replaced by the user, but the use of a standard antenna jack is prohibited.

The EUT use the listed internal antenna.

Remarks:

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.	Next Verif.
CPC 3	FSW43 KMS102-0.2 m	02-02/11-15-001 02-02/50-11-020	05/08/2016	05/08/2015		
MB	FSW43 KMS102-0.2 m	02-02/11-15-001 02-02/50-11-020	05/08/2016	05/08/2015		
SEC 1-3	FSW43 KMS102-0.2 m	02-02/11-15-001 02-02/50-11-020	05/08/2016	05/08/2015		