

Produkte
Products

Prüfbericht - Nr.: 14046519 001		Seite 1 von 20 Page 1 of 20	
<i>Test Report No.:</i>			
Auftraggeber: <i>Client:</i>		Megabyte Limited Unit 507, Building 12W, No. 12 Science Park West Avenue Hong Kong Science Park, Shatin, N.T., Hong Kong	
Gegenstand der Prüfung: <i>Test Item:</i>		UHF RFID fixed reader	
Bezeichnung: <i>Identification:</i>	L2-U, L1-U	Serien-Nr.: <i>Serial No.:</i>	Engineering sample
Wareneingangs-Nr.: <i>Receipt No.:</i>	A000399714-001	Eingangsdatum: <i>Date of Receipt:</i>	26.07.2016
Prüfart: <i>Testing Location:</i>	TÜV Rheinland Hong Kong Ltd. 8/F, First Group Centre, 14 Wang Tai Road, Kowloon Bay, Kowloon, Hong Kong Hong Kong Productivity Council HKPC Building, 78 Tat Chee Avenue, Kowloon, Hong Kong		
Zustand des Prüfgegenstandes bei Anlieferung: <i>Condition of test item at delivery:</i>		Test samples are not damaged and suitable for testing.	
Prüfgrundlage: <i>Test Specification:</i>	FCC Part 15 Subpart C FCC Part 15 Subpart B ANSI C63.10-2013 ANSI C63.4-2014		
Prüfresultat: <i>Test Results:</i>	Das vorstehend beschriebene Gerät wurde geprüft und entspricht oben genannter Prüfgrundlage. The above mentioned product was tested and passed .		
Prüflaboratorium: <i>Testing Laboratory:</i>	TÜV Rheinland Hong Kong Ltd. 8 - 10/F., Goldin Financial Global Square, 7 Wang Tai Road, Kowloon Bay, Kowloon, Hong Kong		
geprüft/ tested by:		kontrolliert/ reviewed by:	
07.12.2016	David Cheng Test Engineer	07.12.2016	Benny Lau Senior Project Manager
Datum <i>Date</i>	Name/Stellung <i>Name/Position</i>	Unterschrift <i>Signature</i>	Datum <i>Date</i>
Sonstiges: Other Aspects		FCC ID: XEK-MLOG	
Abkürzungen:	P(ass) = entspricht Prüfgrundlage F(ail) = entspricht nicht Prüfgrundlage N/A = nicht anwendbar N/T = nicht getestet	Abbreviations:	P(ass) = passed F(ail) = failed N/A = not applicable N/T = not tested
Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens. <i>This test report relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any safety mark on this or similar products.</i>			

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Product information

Manufacturers declarations

	Transmitter
Operating frequency range	902.75 - 927.25 MHz
Type of modulation	DSB-ASK
Number of channels	50
Channel separation	500 kHz
Type of antenna	Integral Plate Antenna
Antenna gain (dBi)	0.0 dBi
Power level	fix
Type of equipment	stand alone radio device
Connection to public utility power line	Yes
Nominal voltage	100-240VAC
Independent Operation Modes	Transmitting, Receiving

Product function and intended use

The equipment under test (EUT) is an UHF RFID reader operating in 902 -928MHz. It is a logistics tray used in jewellery shop to read the ID tag of every shock item and send the information to the application software in the PC. It is powered by AC-DC adaptor.

The manufacturer declared that the model: L2-U are identical to the model L1-U except the plastic housing.

FCC ID: XEK-MLOG

Models	Product description
L2-U, L1-U	UHF RFID fixed reader

Submitted documents

Circuit Diagram
Block Diagram
Technical Description
User manual
Label

Independent Operation Modes

The basic operation modes are:

- Transmitting mode.
- Receiving mode

For further information refer to User Manual

Related Submittal(s) Grants

This device is a composite device.

This is a single application for certification of the UHF RFID transmitter.

The receiver function of the UHF RFID transceiver is authorized under verification procedure.

The PC peripherals function is authorized under the certification procedure (refer to test report 14046520 001 issued by TÜV Rheinland HK Ltd on 07.12.2016).

Remark

The test results in this test report are only relevant to the tested sample and does not involve any assessment in the production.

Test Set-up and Operation Mode

Principle of Configuration Selection

Emission: The equipment under test (EUT) was configured to measure its highest possible radiation level. The test modes were adapted accordingly in reference to the instructions for use.

Test Operation and Test Software

Test operation should refer to test methodology.

- During test, Channel & Power Controlling Software provided by the customer was used to control the operating channel as well as the maximum output power level. The maximum RF output power and the operating frequencies was selected according to the instruction given by the manufacturer. The setting of the maximum RF output power and the operating frequency range expected by the customer shall be fixed on the firmware of the final end product.

Special Accessories and Auxiliary Equipment

The product has been tested together with the following additional accessories:

- AC-DC adaptor Model: EA1024BR-065 Input: 100-240 VAC 50/60 Hz; Output: 6.5VDC 3A)
(Provided by the applicant)
- 3 meter long USB cable incorporating a ferrite core (Provided by the applicant)

Countermeasures to achieve EMC Compliance

- Nil

Test Methodology

Radiated Emission

The radiated emission measurements of the transmitter part were performed according to the procedures in ANSI C63.10-2013. The radiated emission measurements of the receiver part were performed according to the procedures in ANSI C63.4-2014.

For measurement below 1GHz - the equipment under test (EUT) was placed at the middle of the 80 cm height turntable. For measurement above 1GHz - the EUT was placed at the middle of the 1.5 m height turntable and RF absorbing material was placed on ground plane between turntable and measuring antenna.

The investigation is performed with the EUT rotated 360°, the antenna height scanned between 1m and 4m, and the antenna rotated to repeat the measurements for both the horizontal and vertical antenna polarizations. Repeat the measurement steps until the maximum emissions were obtained.

All radiated tests were performed at an antenna to EUT with 3 meters distance, unless stated otherwise in particular parts of this test report.

Field Strength Calculation

The field strength at 3 m was established by adding the meter reading of the spectrum analyzer to the factors associated with antenna correction factor, cable loss, preamplifiers and filter attenuation.

The equation is expressed as follow:

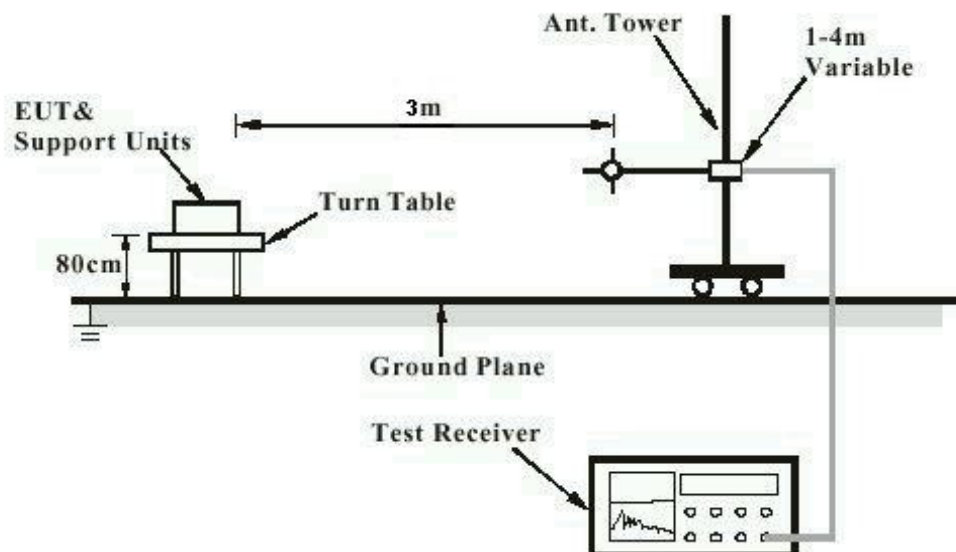
$$FS = R + AF + CF + FA - PA$$

Where FS = Field Strength in dBuV/m at 3 meters.
R = Reading of Spectrum Analyzer in dBuV.
AF = Antenna Factor in dB.
CF = Cable Attenuation Factor in dB.
FA = Filter Attenuation Factor in dB.
PA = Preamplifier Factor in dB.

FA and PA are only be used for the measuring frequency above 1 GHz.

Test Setup Diagram

Diagram of Measurement Configuration for Radiation Test



Note: Measurements above 1 GHz are done with a table height of 1.5m. In addition, there is RF absorbing material on the floor of the test site for above 1GHz measurement.

Diagram of Measurement Equipment Configuration for Mains Conduction Measurement (if applicable)

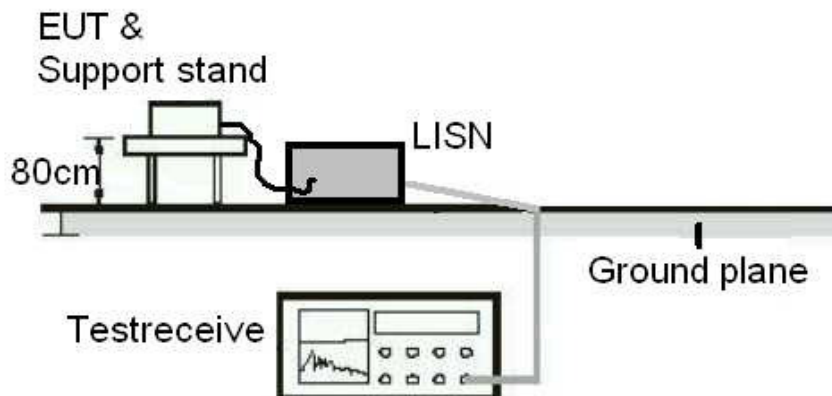
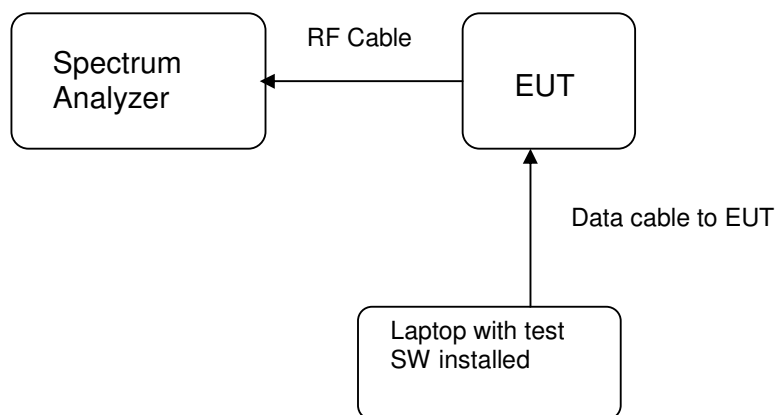


Diagram of Equipment Configuration for Antenna-port Conducted Measurement (if applicable)



List of Test and Measurement Instruments

Hong Kong Productivity Council (FCC Registration number: 90656)

Radiated Emission

Equipment	Manufacturer	Type	Cal. Date	Due Date
Semi-anechoic Chamber	Frankonia	Nil	25-Apr-16	25-Apr-17
New Fully Anchoic Chamber	TDK	N/A	19-Apr-16	19-Apr-17
Cable	Hubersuhner	SUCOFLEX 104	31-Mar-16	31-Mar-18
Test Receiver	R & S	ESU26	7-Dec-15	7-Dec-16
Bi-conical Antenna	R & S	HK116	1-Sep-15	1-Sep-17
Log Periodic Antenna	R & S	HL223	1-Sep-15	1-Sep-17
Coaxial cable	Harbour	LL335	10-Jun-16	10-Jun-18
Microwave amplifier 0.5-26.5GHz, 25dB gain	HP	83017A	18-Jul-16	18-Jul-18
High Pass Filter (cutoff freq. =1000MHz)	Trilithic	23042	28-Oct-15	28-Oct-17
Horn Antenna	EMCO	3115	26-Aug-15	26-Aug-17
Active Loop Antenna	EMCO	6502	27-Oct-16	27-Oct-17

AC Mains Conducted Emission

Equipment	Manufacturer	Type	Cal. Date	Due Date
Test Receiver	R & S	ESU40	7-Dec-15	7-Dec-16
RF Voltage Probe	Schwarzbeck	TK9416	11-Feb-16	11-Feb-17
LISN	R&S	ESH3-Z5	15-Jun-16	15-Jun-17
Double Shield Cable	Radiall	RG142	14-Sep-15	14-Sep-17
Pulse Limiter	R&S	ESH3-Z2	3-Jun-16	3-Jun-18

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Radio Test

Equipment	Manufacturer	Type	Cal. Date	Due Date
Spectrum Analyzer	R & S	FSP30	12-Jan-15	12-Jan-17

Measurement Uncertainty

The estimated combined standard uncertainty for power-line conducted emissions measurements is $\pm 3.43\text{dB}$.

The estimated combined standard uncertainty for radiated emissions measurements is $\pm 5.10\text{dB}$ (30MHz to 200MHz) and $\pm 5.08\text{dB}$ (200MHz to 1000MHz) and is $\pm 5.10\text{dB}$ (30MHz to 200MHz) and $\pm 5.08\text{dB}$ (above 1GHz).

The estimated combined standard uncertainty for antenna conducted emission is $\pm 1.56\text{dB}$

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor of $k=2$, which for the level of confidence is approximately 95%.

Results FCC Part 15 – Subpart C

FCC 15.203 – Antenna Requirement 1		Pass
FCC Requirement: No antenna other than that furnished by the responsible party shall be used with the device		
Results:	a) Antenna type: Fixed Integral Plate Antenna b) Manufacturer and model no: MTI MT-269508 c) Peak Gain: 0 dBi	
Verdict:	Pass	

FCC 15.204 – Antenna Requirement 2		N/A
FCC Requirement: An intentional radiator may be operated only with the antenna with which it is authorized. If an antenna is marketed with the intentional radiator, it shall be of a type which is authorized with the intentional radiator.		
Results:	Only the integral antenna can be used.	
Verdict:	N/A	

FCC 15.207 – Conducted Emission on AC Mains						Pass
Test Specification : ANSI C63.10 – 2013 Mode of operation : TX mode Port of testing : AC Mains input port of power supply Supply voltage : 120Vac 60Hz Temperature : 23°C Humidity : 50%						
Requirement:		15.207(a)				
Results:		Pass				
Live measurement						
Frequency range (MHz)	Frequency (MHz)	Quasi-peak dBμV	Average dBμV	Limit QP (dBμV)	Limit AV (dBμV)	Verdict
0,15 – 0,5	0.154	56.6	36.6	66 - 56	56 - 46	Pass
> 0,5 - 5	No peak found	---	---	56	46	Pass
> 5 - 30	No peak found	---	---	60	50	Pass
Neutral measurement						
Frequency range (MHz)	Frequency (MHz)	Quasi-peak dBμV	Average dBμV	Limit QP (dBμV)	Limit AV (dBμV)	Verdict
0,15 – 0,5	0.154	56.9	37.6	66 - 56	56 - 46	Pass
> 0,5 - 5	No peak found	---	---	56	46	Pass
> 5 - 30	No peak found	---	---	60	50	Pass

Results: Pre-scan has been conducted to determine the worst-case mode from all possible combinations between available modulations and data rate.

The radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150kHz to 30MHz does not exceed the limits. For test Results plots refer to Appendix 1.

FCC 15.247 (b)(2) – Peak Output Power			Pass
Test Specification : ANSI C63.10 – 2013 Mode of operation : Tx mode Port of testing : Temporary antenna port Supply voltage : 120VAC Temperature : 23°C Humidity : 50%			
FCC Requirement : For frequency hopping systems operating in the 902-928 MHz band: 1 watt for systems employing at least 50 hopping channels; and, 0.25 watts for systems employing less than 50 hopping channels.			
Results: For test protocols please refer to Appendix 1.			
Frequency (MHz)	Maximum peak output power (dBm)	Limit (dBm)	Verdict
902.75	28.74	30.0	Pass
915.25	28.99	30.0	Pass
927.25	29.13	30.0	Pass

FCC 15.247 (a)(1)(i) – 20 dB Bandwidth			Pass
Test Specification : ANSI C63.10 – 2013 Mode of operation : Tx mode Port of testing : Temporary antenna port Supply voltage : 120VAC Temperature : 23°C Humidity : 50%			
FCC Requirement : The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.			
Results: Pre-scan has been conducted to determine the worst-case mode from all possible combinations between available modulations and packet types. For test protocols refer to Appendix 1.			
Frequency (MHz)	20 dB left (MHz)	20 dB right (MHz)	20dB bandwidth (kHz)
902.75	902.7174	902.7944	77.0
915.25	915.2176	915.2944	76.8
927.25	927.2176	927.2944	76.8

FCC 15.247(a)(1) – Carrier Frequency Separation		Pass
Test Specification : ANSI C63.10 – 2013 Mode of operation : Tx mode (hopping on) Port of testing : Temporary antenna port Supply voltage : 120VAC Temperature : 23°C Humidity : 50%		
FCC Requirement: Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.		
Results: Pre-scan has been conducted to determine the worst-case mode from all possible combinations between available modulations and packet types. For test Results plots refer to Appendix 1.		
Channel Separation (kHz)	Limit (kHz)	Verdict
502	77	Pass

FCC 15.247 (a)(1)(iii)/ RSS-247 5.1(4) – Number of hopping channels		Pass
Test Specification : ANSI C63.10 – 2013 Mode of operation : Tx mode (hopping on) Port of testing : Temporary antenna port Supply voltage : 120VAC Temperature : 23°C Humidity : 50%		
FCC Requirement: For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies.		
Results: For test Results plots refer to Appendix 1.		
No. of hopping channels	Limit	Verdict
50	50	Pass

FCC 15.247 (a)(1)(iii)/ RSS-247 5.1(4) – Time of Occupancy (Dwell Time)				Pass
Test Specification : ANSI C63.10 – 2013 Mode of operation : Tx mode (hopping on) Port of testing : Temporary antenna port Supply voltage : 120VAC Temperature : 23°C Humidity : 50%				
FCC Requirement: The average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period.				
Results: For test Results plots refer to Appendix 1.				
No. of TX in 20 sec	TX time (ms)	Dwell Time (ms)	Limit (ms)	Verdict
1	400	400	400	Pass

FCC 15.247 (a) – Hopping Sequence	Pass
FCC Requirement: The system radio frequency (RF) bandwidth is equal to the channel bandwidth multiplied by the number of channels in the hopset. The hopset shall be such that the near-term distribution of frequencies appears random, with sequential hops randomly distributed in both direction and magnitude of change in the hopset, while the long-term distribution appears evenly distributed.	
As stated in the technical description, the hopping sequence is a pseudorandom sequence generated by the deterministic random bit generator routine in the Firmware, initially seeded with a truly random number, that hops are randomly distributed in both direction and magnitude of change in the hop set which meet the requirement specified in the definition of FCC part 2 section 2.1.	

FCC 15.247 (a) – Equal Hopping Frequency Use	Pass
FCC Requirement: Each of the transmitter's hopping channels is used equally on average.	
The system radio frequency (RF) bandwidth is equal to the channel bandwidth multiplied by the number of channels in the hopset. The hopset shall be such that the near-term distribution of frequencies appears random, with sequential hops randomly distributed in both direction and magnitude of change in the hopset, while the long-term distribution appears evenly distributed.	
As stated in the technical description, the formula will generate a pseudorandom repeating hopping sequence which each hopping channels is used equally on average in long term.	

FCC 15.247 (a) – Receiver Input Bandwidth	Pass
FCC Requirement: The associated receiver(s) complies with the requirement that its input bandwidth matches the bandwidth of the transmitted signal.	
As stated in the technical description, in each hopping channel, the RFID module send the command to the tag or receiving backscatter from the tag alternately. The receiver bandwidth is equal to the transmitter bandwidth in the hopping channels	

FCC 15.247 (a) – Receiver Hopping Capability	Pass
FCC Requirement: The associated receiver has the ability to shift frequencies in synchronisation with the transmitted signals.	
As stated in the technical description, when the RFID module is sending command to the tag, the reader is sending out continuous wave signal with AC power and clock signal. Then, tag converts the AC power to DC and energizes the tag microchip. Clock signal is also extracted from the received signal. Tag modulates the received signal encoding its data and transmits it back to the reader antenna in the same channel. The reader decodes the received signal to extract the tag data.	

FCC 15.247 (d) – Spurious Conducted Emissions				Pass	
Test Specification : ANSI C63.10 – 2013 Mode of operation : Tx mode Port of testing : Temporary antenna port Supply voltage : 120VAC Temperature : 23 °C Humidity : 50 %					
FCC Requirement: In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.					
Results: Pre-scan has been conducted to determine the worst-case mode from all possible combinations between available modulations and packet types. There is no peak found outside any 100kHz bandwidth of the operating frequency band in the three transmit frequency. All three transmit frequency modes comply with the limit stated in subclause 15.247(d). For test protocols refer to Appendix 1.					
Operating frequency (MHz)	Spurious frequency (MHz)	Spurious Level (dBm)	Reference value (dBm)	Delta (dB)	Verdict
902.75	7466.000	0.23	28.74	28.51	Pass
915.25	7424.000	0.57	28.99	28.42	Pass
927.25	9258.000	-0.31	29.13	29.44	Pass

FCC 15.205 – Radiated Emissions in Restricted Frequency Bands			Pass
Test Specification : ANSI C63.10 – 2013 Mode of operation : TX mode Port of testing : Enclosure Detector : Peak RBW/VBW : 100 kHz / 300 kHz for $f < 1$ GHz 1 MHz / 3 MHz for $f > 1$ GHz Supply voltage : 120VAC Frequency range : 9kHz to 10GHz Temperature : 23°C Humidity : 50%			
FCC Requirement: In any 100kHz bandwidth outside the frequency band at least 20dB below the highest level of the desired power. In addition, radiated emissions which fall in the restricted bands, as defined in section 15.205(a), must also comply with the radiated emission limits specified in section 15.205(c).			
Results: Pre-scan has been conducted to determine the worst-case mode from all possible combinations between available modulations and data rate. All three transmit frequency modes comply with the field strength within the restricted bands. There is no spurious found below 30MHz.			
Mode: 902.75 MHz TX		Vertical Polarization	
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m	
1805.532	48.25	74.0 / PK	
1805.468	37.70	54.0 / AV	
4513.590	59.41	74.0 / PK	
4513.702	38.83	54.0 / AV	
Mode: 902.75 MHz TX		Horizontal Polarization	
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m	
1805.196	48.40	74.0 / PK	
1805.163	39.00	54.0 / AV	
4513.878	54.51	74.0 / PK	
4513.686	42.48	54.0 / AV	
Mode: 915.25 MHz TX		Vertical Polarization	
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m	
1830.196	48.97	74.0 / PK	
1830.420	37.66	54.0 / AV	
3660.856	54.69	74.0 / PK	
3661.032	43.64	54.0 / AV	
Mode: 915.25 MHz TX		Horizontal Polarization	
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m	
1830.724	48.37	74.0 / PK	
1830.564	36.65	54.0 / AV	

Mode: 927.25 MHz TX			Vertical Polarization		
Freq MHz		Level dBuV/m		Limit/ Detector dBuV/m	
1854.548		48.53		74.0 / PK	
1854.356		35.38		54.0 / AV	
3709.192		53.61		74.0 / PK	
3709.192		40.59		54.0 / AV	
Mode: 927.25 MHz TX			Horizontal Polarization		
Freq MHz		Level dBuV/m		Limit/ Detector dBuV/m	
1854.708		47.59		74.0 / PK	
1854.532		35.62		54.0 / AV	
4636.010		53.30		74.0 / PK	
4636.202		40.49		54.0 / AV	

Results FCC Part 15 – Subpart B

FCC 15.107 – Conducted Emission on AC Mains						Pass
Test Specification : ANSI C63.4 – 2014 Mode of operation : RX mode Port of testing : AC Mains input port of power supply Supply voltage : 120Vac 60Hz Temperature : 23°C Humidity : 50%						
Requirement: 15.107(a)						
Results: Pass						
Live measurement						
Frequency range (MHz)	Frequency (MHz)	Quasi-peak dBμV	Average dBμV	Limit QP (dBμV)	Limit AV (dBμV)	Verdict
0,15 – 0,5	0.150	51.1	31.7	66 - 56	56 - 46	Pass
> 0,5 - 5	No peak found	---	---	56	46	Pass
> 5 - 30	No peak found	---	---	60	50	Pass
Neutral measurement						
Frequency range (MHz)	Frequency (MHz)	Quasi-peak dBμV	Average dBμV	Limit QP (dBμV)	Limit AV (dBμV)	Verdict
0,15 – 0,5	0.150	51.3	31.6	66 - 56	56 - 46	Pass
> 0,5 - 5	No peak found	---	---	56	46	Pass
> 5 - 30	No peak found	---	---	60	50	Pass

FCC 15.109 – Radiated Emission		Pass
Test Specification : ANSI C63.4 – 2014 Mode of operation : RX mode Port of testing : Enclosure Supply voltage : 120VAC Frequency range : 30MHz to 5GHz Temperature : 23°C Humidity : 50%		
FCC Requirement: 15.109(a)		
Results: Pre-scan has been conducted to determine the worst-case mode from all possible combinations between available modulations and data rate.		
Vertical Polarization		
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
54.212	29.7	40.0 / QP
192.210	29.9	43.5 / QP
480.000	24.6	46.0 / QP
No peak found	---	54.0 / PK
Horizontal Polarization		
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
54.212	21.3	40.0 / QP
192.100	27.6	43.5 / QP
480.000	24.5	46.0 / QP
No peak found	---	54.0 / PK