

Prüfbericht-Nr.: <i>Test Report No.:</i>	50049530 001	Auftrags-Nr.: <i>Order No.:</i>	114052648	Seite 1 von 33 Page 1 of 33																								
Kunden-Referenz-Nr.: <i>Client Reference No.:</i>	N/A	Auftragsdatum: <i>Order date:</i>	21-Jun-2016																									
Auftraggeber: <i>Client:</i>	N.V. Nederlandsche Apparatenfabriek "Nedap" , Parallelweg 2, 7141 DC Groenlo, The Netherlands																											
Prüfgegenstand: <i>Test item:</i>	Wireless Space Count System for Parking Lots																											
Bezeichnung / Typ-Nr.: <i>Identification / Type No.:</i>	SENSIT IR US/ SENSIT FLUSH MOUNT US																											
Auftrags-Inhalt: <i>Order content:</i>	FCC/IC Test report																											
Prüfgrundlage: <i>Test specification:</i>	FCC 47CFR Part 15: Subpart C Section 15.247 RSS-247 (05-2015)																											
Wareneingangsdatum: <i>Date of receipt:</i>	1-Jul-2016																											
Prüfmuster-Nr.: <i>Test sample No.:</i>	A000386950-027																											
Prüfzeitraum: <i>Testing period:</i>	11-Jul-2016 - 6-Dec-2016																											
Ort der Prüfung: <i>Place of testing:</i>	EMC Laboratory Taipei																											
Prüflaboratorium: <i>Testing laboratory:</i>	TUV Rheinland Taiwan Ltd.																											
Prüfergebnis*: <i>Test result*:</i>	Pass																											
geprüft von / tested by:		kontrolliert von / reviewed by:																										
05-Jan-2017 Ryan W. T. Chen / Project Engineer		05-Jan-2017 Rene Charton/Senior Project Manager																										
<i>Datum</i>	<i>Name / Stellung</i>	<i>Unterschrift</i>	<i>Datum</i>	<i>Name / Stellung</i>																								
<i>Date</i>	<i>Name / Position</i>	<i>Signature</i>	<i>Date</i>	<i>Name / Position</i>																								
Sonstiges / Other:																												
Zustand des Prüfgegenstandes bei Anlieferung: <i>Condition of the test item at delivery:</i>		Prüfmuster vollständig und unbeschädigt <i>Test item complete and undamaged</i>																										
<table style="width:100%; border: none;"> <tr> <td>* Legende:</td> <td>1 = sehr gut</td> <td>2 = gut</td> <td>3 = befriedigend</td> <td>4 = ausreichend</td> <td>5 = mangelhaft</td> </tr> <tr> <td></td> <td>P(ass) = entspricht o.g. Prüfgrundlage(n)</td> <td>F(ail) = entspricht nicht o.g. Prüfgrundlage(n)</td> <td>N/A = nicht anwendbar</td> <td>N/T = nicht getestet</td> <td></td> </tr> <tr> <td>Legend:</td> <td>1 = very good</td> <td>2 = good</td> <td>3 = satisfactory</td> <td>4 = sufficient</td> <td>5 = poor</td> </tr> <tr> <td></td> <td>P(ass) = passed a.m. test specification(s)</td> <td>F(ail) = failed a.m. test specification(s)</td> <td>N/A = not applicable</td> <td>N/T = not tested</td> <td></td> </tr> </table>					* Legende:	1 = sehr gut	2 = gut	3 = befriedigend	4 = ausreichend	5 = mangelhaft		P(ass) = entspricht o.g. Prüfgrundlage(n)	F(ail) = entspricht nicht o.g. Prüfgrundlage(n)	N/A = nicht anwendbar	N/T = nicht getestet		Legend:	1 = very good	2 = good	3 = satisfactory	4 = sufficient	5 = poor		P(ass) = passed a.m. test specification(s)	F(ail) = failed a.m. test specification(s)	N/A = not applicable	N/T = not tested	
* Legende:	1 = sehr gut	2 = gut	3 = befriedigend	4 = ausreichend	5 = mangelhaft																							
	P(ass) = entspricht o.g. Prüfgrundlage(n)	F(ail) = entspricht nicht o.g. Prüfgrundlage(n)	N/A = nicht anwendbar	N/T = nicht getestet																								
Legend:	1 = very good	2 = good	3 = satisfactory	4 = sufficient	5 = poor																							
	P(ass) = passed a.m. test specification(s)	F(ail) = failed a.m. test specification(s)	N/A = not applicable	N/T = not tested																								
<p>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.</p> <p><i>This test report only 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 test mark.</i></p>																												

TEST SUMMARY

5.1.1 ANTENNA REQUIREMENT*RESULT: Passed***5.1.2 PEAK OUTPUT POWER***RESULT: Passed***5.1.3 20dB BANDWIDTH***RESULT: Passed***5.1.4 CONDUCTED SPURIOUS EMISSIONS AND FREQUENCY BAND EDGE MEASURED IN 100KHZ BANDWIDTH***RESULT: Passed***5.1.5 SPURIOUS EMISSION***RESULT: Passed***5.1.6 FREQUENCY SEPARATION***RESULT: Passed***5.1.7 NUMBER OF HOPPING FREQUENCY***RESULT: Passed***5.1.8 TIME OF OCCUPANCY***RESULT: Passed*

Contents

1.	GENERAL REMARKS	4
1.1	COMPLEMENTARY MATERIALS.....	4
2.	TEST SITES	5
2.1	TEST FACILITIES	5
2.2	LIST OF TEST AND MEASUREMENT INSTRUMENTS.....	6
2.3	TRACEABILITY	7
2.4	CALIBRATION	7
2.5	MEASUREMENT UNCERTAINTY	7
3.	GENERAL PRODUCT INFORMATION.....	8
3.1	PRODUCT FUNCTION AND INTENDED USE	8
3.2	SYSTEM DETAILS AND RATINGS.....	8
3.3	INDEPENDENT OPERATION MODES.....	9
3.4	NOISE GENERATING AND NOISE SUPPRESSING PARTS	10
3.5	SUBMITTED DOCUMENTS.....	10
4.	TEST SET-UP AND OPERATION MODES.....	11
4.1	PRINCIPLE OF CONFIGURATION SELECTION	11
4.2	TEST OPERATION AND TEST SOFTWARE.....	11
4.3	SPECIAL ACCESSORIES AND AUXILIARY EQUIPMENT	11
4.4	COUNTERMEASURES TO ACHIEVE EMC COMPLIANCE.....	12
4.5	TEST SETUP DIAGRAM	12
5.	TEST RESULTS	13
5.1	TRANSMITTER REQUIREMENT & TEST SUITES.....	13
5.1.1	<i>Antenna Requirement</i>	<i>13</i>
5.1.2	<i>Peak Output Power</i>	<i>14</i>
5.1.3	<i>20dB Bandwidth</i>	<i>16</i>
5.1.4	<i>99% Bandwidth</i>	<i>19</i>
5.1.5	<i>Conducted spurious emissions and Frequency Band Edge measured in 100kHz Bandwidth.....</i>	<i>22</i>
5.1.6	<i>Spurious Emission</i>	<i>26</i>
5.1.7	<i>Frequency Separation.....</i>	<i>27</i>
5.1.8	<i>Number of hopping frequency.....</i>	<i>29</i>
5.1.9	<i>Time of Occupancy</i>	<i>31</i>
6.	LIST OF TABLES	33

1. General Remarks

1.1 Complementary Materials

All attachments are integral parts of this test report. This applies especially to the following appendix:

- Appendix P: Photo Documentation**
(File Name: 50049530APPENDIX P)
- Appendix D: Test Result of Radiated Emissions**
(File Name: 50049530APPENDIX D)
- Appendix S: Test Setup**
(File Name: 50049530APPENDIX S)

Test Specifications

The following standards were applied

Table 1: Applied Standard and Test Levels

Radio
FCC CFR47 Part 15: Subpart C Section 15.247 RSS-247 Issue 1 May 2015 RSS-Gen, Issue 4, November 2014 ANSI C63.10:2013

2. Test Sites

2.1 Test Facilities

TUV Rheinland Taiwan Ltd.

11F. No.758, Sec. 4, Bade Rd., Songshan Dist.
Taipei City 105
Taiwan (R.O.C.)

FCC Registration No.: 365730
IC Canada Registration No.: 9465A-1
TAF Accredited NCC Test Lab. No.:0759

TAF Accreditation effective period: 2016-Jul-1st to 2019-Jun-30th



Testing Laboratory
0759

2.2 List of Test and Measurement Instruments

Table 2: List of Test and Measurement Equipment

Kind of Equipment	Manu-facturer	Type	S/N	Last Calibration	Next Calibration
Test Software	Farad	EZ_EMG	Ver. TUV3A1	N/A	N/A
EMI Test Receiver	R&S	ESR7	101062	2015/09/10	2016/09/10
Spectrum Analyzer	R&S	FSV 40	100921	2016/04/21	2017/04/21
Spectrum Analyzer	Agilent	N9010A	MY53470241	2016/04/25	2017/04/24
Preamplifier (30MHz -1GHz)	HP	8447F	2805A03335	2015/08/31	2016/08/31
Preamplifier (18 GHz -40 GHz)	COM-POWER	PAM-840	461257	2015/11/19	2016/11/19
Pre-Amplifier (1GHz~18GHz)	EM Electronics	EM01G18G	060558	2015/11/19	2016/11/19
Bilog Antenna	TESEQ	CBL6111D	29802	2014/07/04	2016/08/04
Horn Antenna	ETS-Lindgren	3117	138160	2016/05/03	2017/05/03
Horn Antenna (18GHz~40GHz)	COM-POWER	AH840	101031	2015/11/02	2016/11/02
Loop Antenna	Schwarzbeck	FMZB 1513	1513-076	2016/05/11	2017/05/11
EMI Test Receiver	R&S	ESC17	100797	2015/12/28	2016/12/27
Spectrum Analyzer	R&S	FSL3	101943	2015/09/07	2017/09/07

2.3 Traceability

All measurement equipment calibrations are traceable to NML(Taiwan)/NIST(USA) or where calibration is performed outside Taiwan, to equivalent nationally recognized standards organizations.

2.4 Calibration

requiring calibration is calibrated periodically in a suitably accredited Calibration Lab. Additionally all equipment is verified for proper performance on a regular basis using in house standards or comparisons.

2.5 Measurement Uncertainty

The estimated combined standard uncertainty for radiated emissions and conducted emissions measurements:

Table 3: Emission Measurement Uncertainty

Parameter	Uncertainty
Radio Frequency	$\pm 1 \times 10^{-7}$
RF power, conducted	± 1.5 dB
RF power density, conducted	± 3 dB
spurious emissions, conducted	± 3 dB
all emissions, radiated	± 6 dB
Temperature	± 1 °C
Humidity	± 5 %
DC and low frequency voltages	± 3 %

3. General Product Information

3.1 Product Function and Intended Use

The EUT is a device for parking occupancy detection of individual spaces through identification of the car. It can communicate with a Datacollector through a wireless interface. For details refer to the User Guide, Data Sheet and Circuit Diagram.

The device tested for all item (SENSIT IR US) is intended to be, for the lower part, buried into a hole in the ground surface.

There is a second version which is intended to be completely buried into a hole in the ground surface so that the upper surface sensor is "flush" with the ground surface. (SENSIT FLUSH MOUNT US).

All tests have been carried out with the SENSIT IR US and radiated emissions were carried out on the SENSIT FLUSH MOUNT US.

3.2 System Details and Ratings

Table 4: Basic Information of EUT

Item	EUT information
Kind of Equipment	Wireless Space Count System for Parking Lots
Type Designation	SENSIT IR US/ SENSIT FLUSH MOUNT US
FCC ID	CGDSENSIT
Canada ID	1444A-SENSIT

Table 5: Technical Specification of EUT

Technical Specification	Value
Operating Frequency	902.4MHz - 927.6MHz
Channel Spacing	400 kHz
Channel number	63 (hopping)
Operation Voltage	3 V
Modulation	GFSK
Antenna gain	-2dBi

3.3 Independent Operation Modes

The basic operation modes are:

- A. Transmitting
 - 1. Low channel
 - 2. Middle channel
 - 3. High channel

3.4 Noise Generating and Noise Suppressing Parts

Refer to the Circuit Diagram.

3.5 Submitted Documents

- Circuit Diagram
- Instruction Manual
- Rating Label
- Technical Description

4. Test Set-up and Operation Modes

4.1 Principle of Configuration Selection

The equipment under test (EUT) was configured to measure its maximum power level. The test modes were adapted accordingly in reference to the instructions for use.

4.2 Test Operation and Test Software

Test operation refers to test setup in chapter 4. All testing were performed according to the procedures in ANSI C63.10 .

The samples were used as follows:
Flush mount: A000386950-028
Surface Mount: A000386950-027

4.3 Special Accessories and Auxiliary Equipment

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

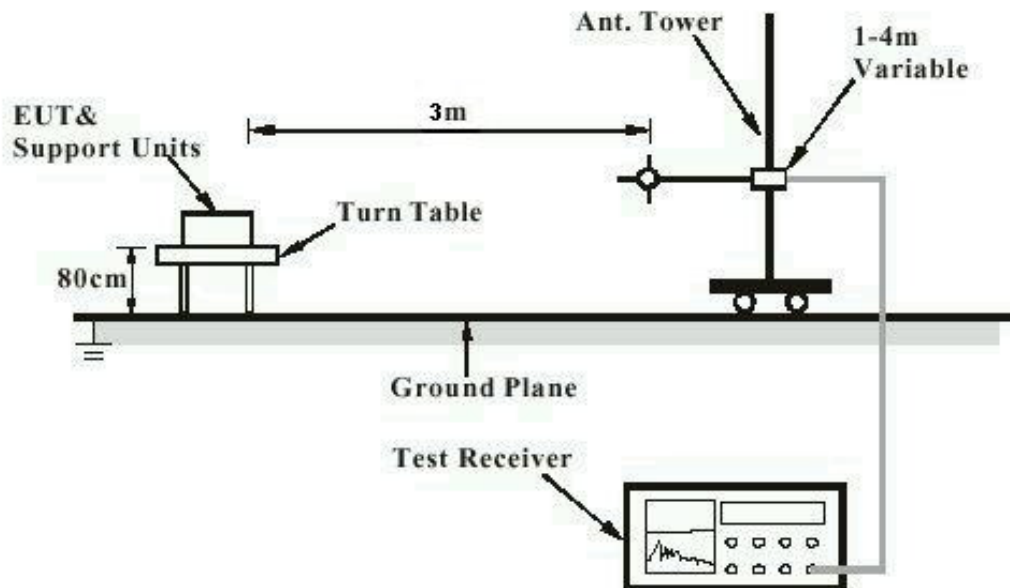
None

4.4 Countermeasures to achieve EMC Compliance

The test sample which has been tested containing the noise suppression parts as in the Photo Appendix and the Test Setup Photos. No additional measures were employed to achieve compliance.

4.5 Test Setup Diagram

Diagram of Measurement Configuration for Radiation Test



5. Test Results

5.1 Transmitter Requirement & Test Suites

5.1.1 Antenna Requirement

RESULT:**Passed**

Test standard	:	FCC Part 15.247(b)(4), Part 15.203 and RSS-Gen 8.3
Requirement	:	use of approved antennas only

According to the manufacturer declaration, the EUT has an antenna with a directional gain of -2 dBi. The antenna is a top-loaded whip antenna with no possibility of replacement with a non-approved antenna by the end-user. Therefore, the EUT is considered to comply with this provision.

Refer to EUT photo for details.

Prüfbericht - Nr.: 50049530 001

Test Report No.

Seite 14 von 33

Page 14 of 33

5.1.2 Peak Output Power

RESULT:**Passed**

Test standard : FCC Part 15.247(b)(1),
RSS-247 5.4(2)

Basic standard : ANSI C63.10:2013
LP0002(2011) Appendix II

Kind of test site : Semi-Anechoic Chamber

Test setup

Test Channel : Low/ Middle/ High

Operation Mode : A

Ambient temperature : 20-24 °C

Relative humidity : 50-65 %

Atmospheric pressure : 100-103 kPa

Table 6: Test result of Peak Output

Channel	Channel Frequency	Peak Output Power		Limit
	(MHz)	(dBm)	(W)	
Low Channel	902.4 MHz	5.47	0.00352	1
Middle Channel	915 MHz	5.36	0.00344	1
High Channel	927.6 MHz	4.83	0.00304	1

Test procedure:

Since the EUT has no connector port available for conducted measurements the test results are obtained by radiated measurement using the setup for radiated emissions. From the measured radiated field strength at a distance of 3m and the antenna gain **G** (as declared by the applicant) the peak conducted output power value is calculated. This value is calculated using the formula:

E is the measured maximum fundamental field strength in V/m

- > -21.3 dBV/m = 0.086 V/m @ 902.4 MHz
- > -21.4 dBV/m = 0.085 V/m @ 915 MHz
- > -21.9 dBV/m = 0.08 V/m @ 927.6 MHz

G is the numeric gain of the transmitting antenna with reference to an isotropic radiator.

- > -2 dBi => 0.631

d is the distance in meters from which the field strength was measured.

- > 3m

P is the power in watts:

$$P = \frac{(E \cdot d)^2}{30G}$$

- @ 902.4 MHz SQ(0.086 *3) / 18.93 = 0.00352 W = 5.47 dBm
- @ 915 MHz SQ(0.085 *3) / 18.93 = 0.00344 W = 5.36 dBm
- @ 927.6 MHz SQ(0.08 *3) / 18.93 = 0.00304 W = 4.83 dBm

For details refer to Appendix D.

5.1.3 20dB Bandwidth

RESULT:**Passed**

Test standard : FCC Part 15.247(a)(1),
RSS-247 5.1(1)
Basic standard : ANSI C63.10:2013
Kind of test site : Semi-Anechoic Chamber

Test setup

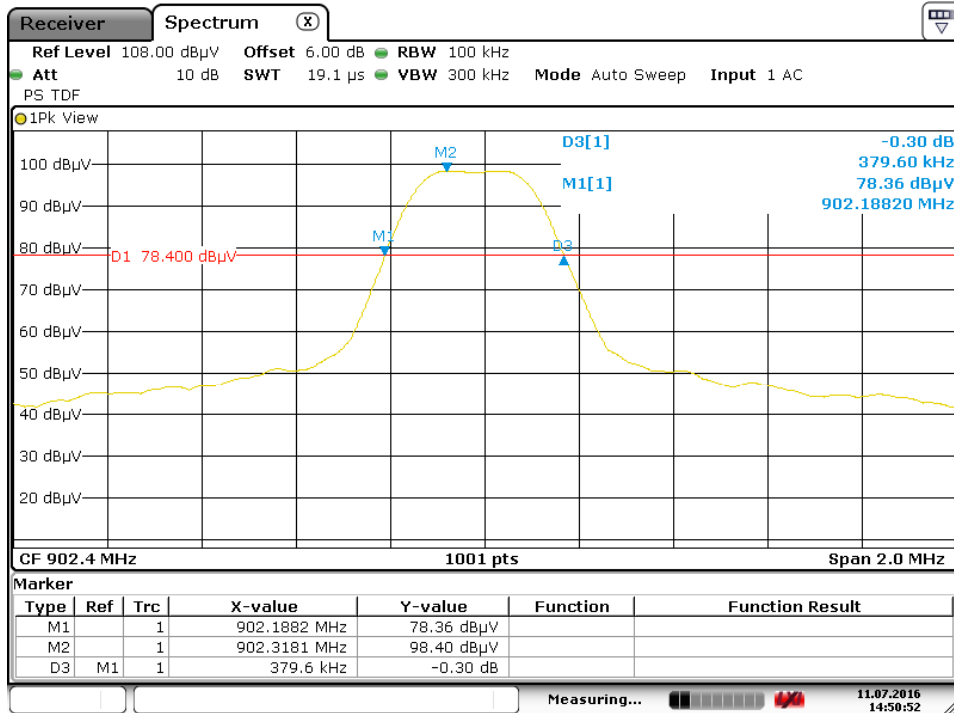
Test Channel : Low/ Middle/ High
Operation Mode : A
Ambient temperature : 20-24°C
Relative humidity : 50-65%
Atmospheric pressure : 100-103kPa

Table 7: Test result of 20dB Bandwidth,

Channel	Channel Frequency (MHz)	20dB Bandwidth (kHz)	Limit (kHz)	Result
Low Channel	902.4 MHz	379.6	< 500	Pass
Mid Channel	915.12MHz	367.6	< 500	Pass
High Channel	927.6 MHz	360.2	< 500	Pass

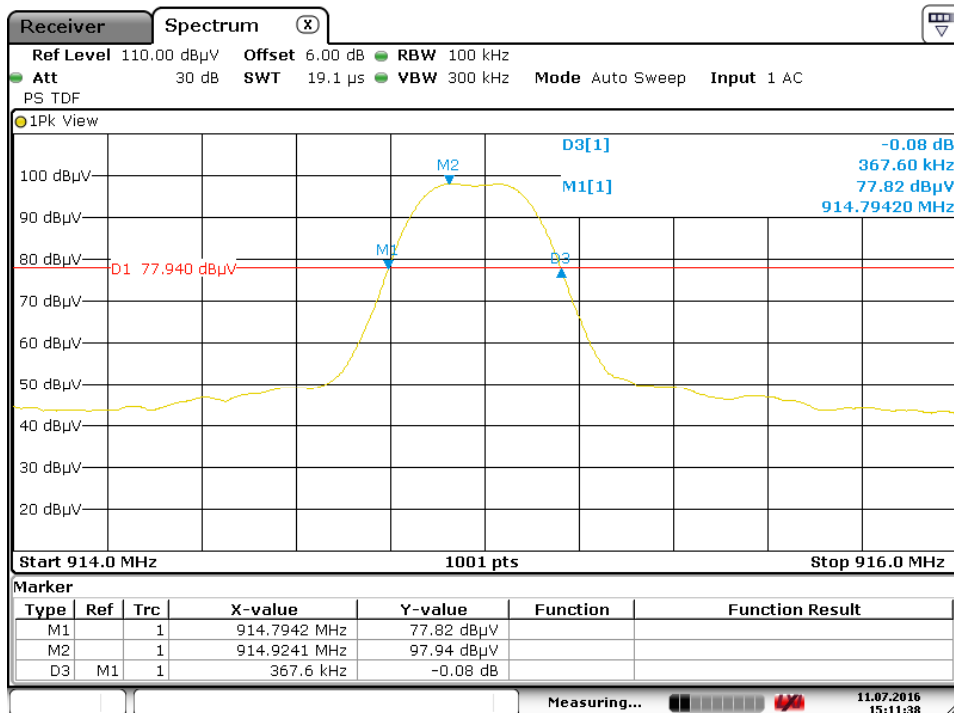
Test Plot of 20dB Bandwidth

Low Channel



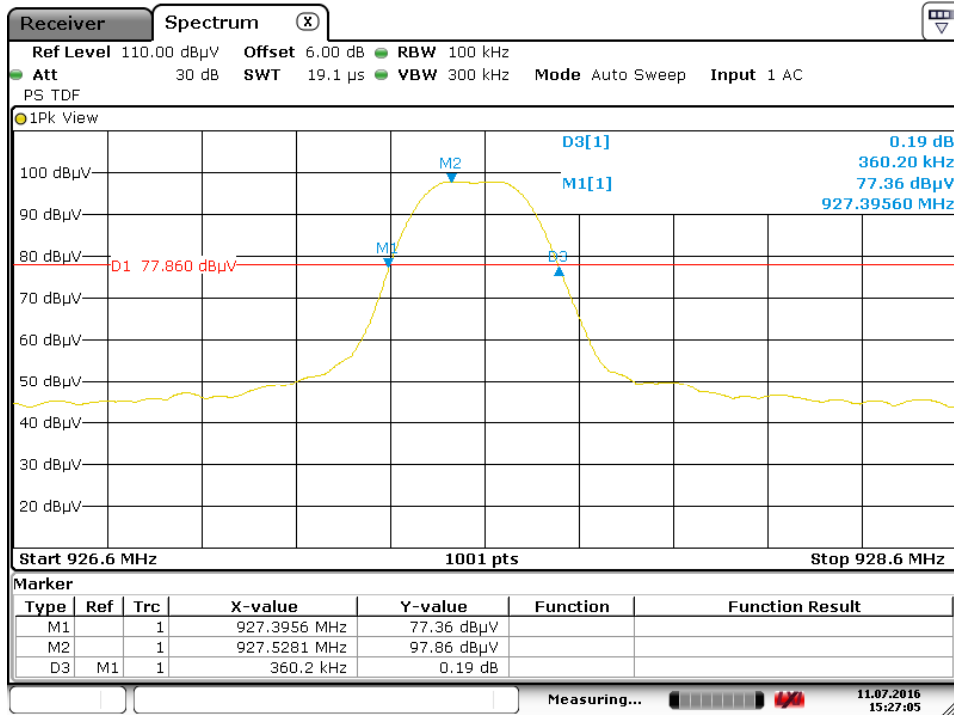
Date: 11.JUL.2016 14:50:52

Middle Channel



Date: 11.JUL.2016 15:11:39

High Channel



Date: 11.JUL.2016 15:27:05

5.1.4 99% Bandwidth

RESULT:**Passed**

Test standard : RSS-Gen, Issue 4, November 2014
Basic standard : ANSI C63.10:2013
Kind of test site : Semi-Anechoic Chamber

Test setup

Test Channel : Low/ Middle/ High
Operation Mode : A

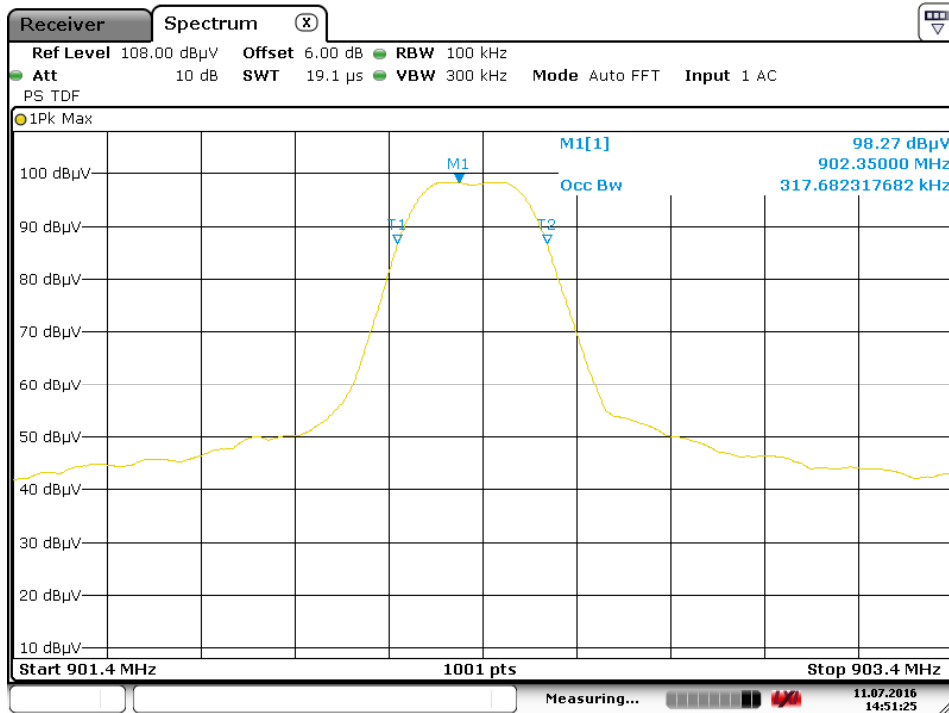
Ambient temperature : 20-24°C
Relative humidity : 50-65%
Atmospheric pressure : 100-103 kPa

Table 8: Test result of 99% Bandwidth, GFSK modulation

Channel	Channel Frequency (MHz)	99% Bandwidth (kHz)
Low Channel	902.4 MHz	318
Mid Channel	915.14 MHz	308
High Channel	927.6 MHz	300

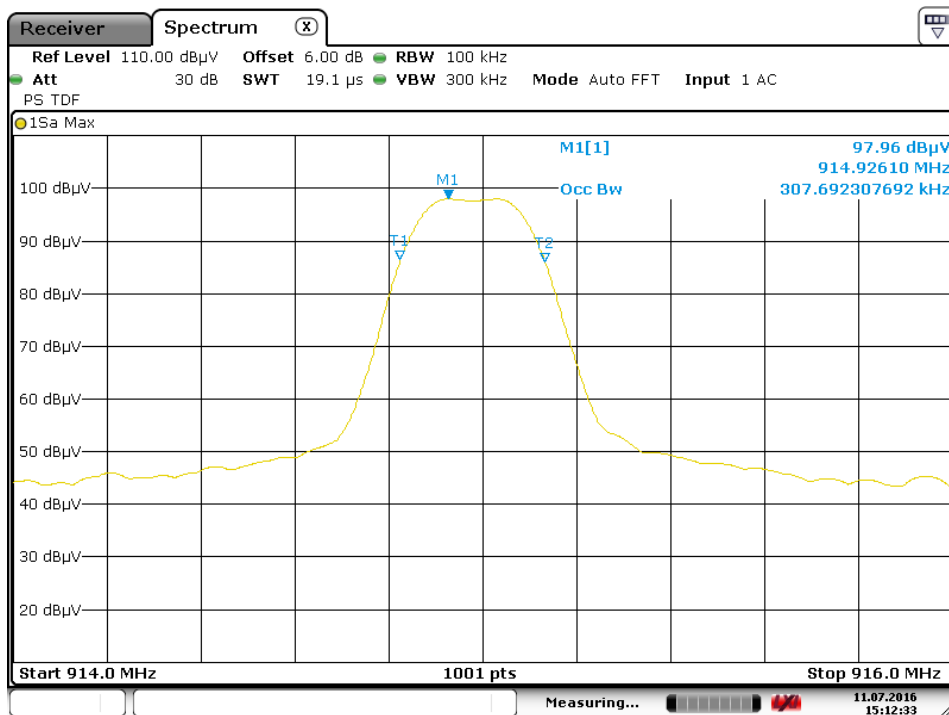
Test Plot of 99% Bandwidth

Low Channel

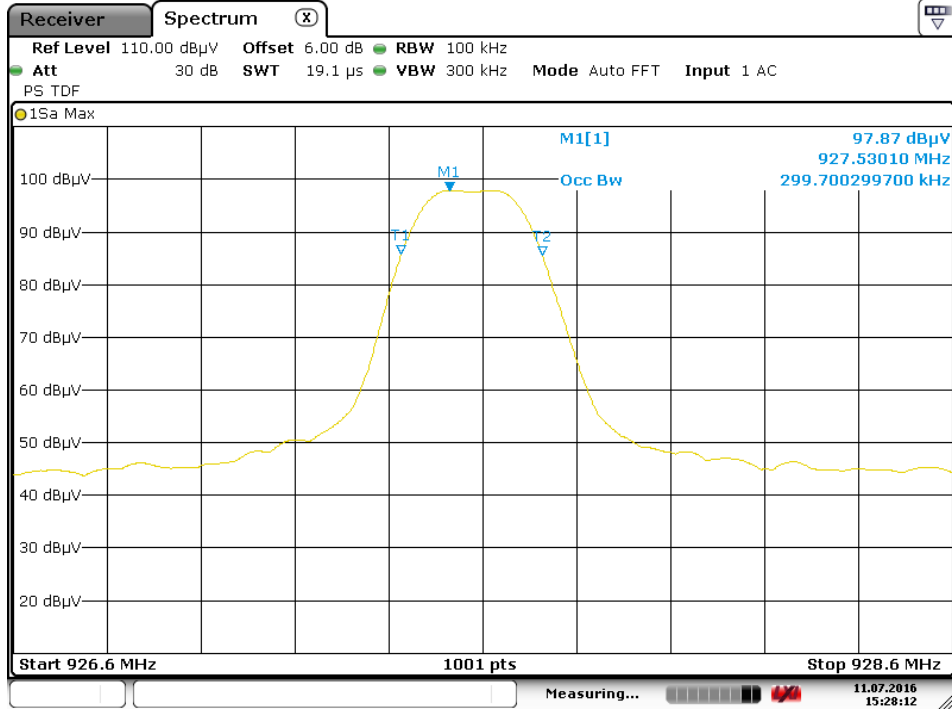


Date: 11.JUL.2016 14:51:25

Middle Channel



Date: 11.JUL.2016 15:12:33

High Channel


Date: 11.JUL.2016 15:28:12

5.1.5 Radiated spurious emissions and Frequency Band Edge measured in 100kHz Bandwidth

RESULT:**Passed**

Test standard	:	FCC part 15.247(d), RSS-247 5.5
Basic standard	:	ANSI C63.10:2013
Limit	:	20dB (below that in the 100kHz bandwidth within the band that contains the highest level of the desired power)
Kind of test site	:	Semi-Anechoic Chamber

Test setup

Test Channel	:	Low/High/Hopping
Operation Mode	:	A
Ambient temperature	:	20-24°C
Relative humidity	:	50-65%
Atmospheric pressure	:	100-103 kPa

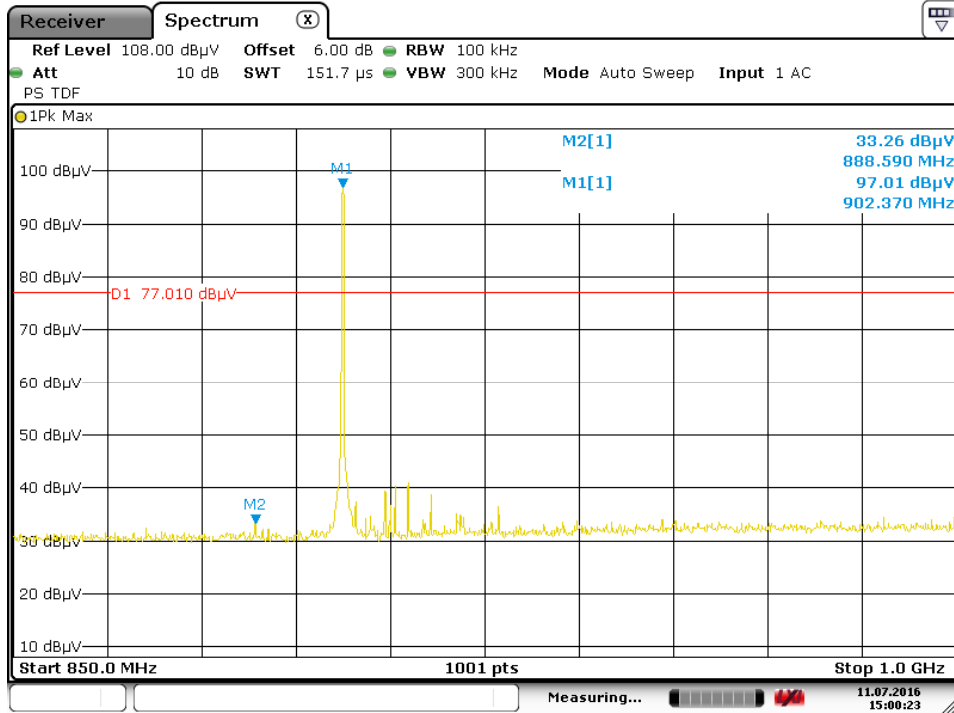
All emissions are more than 20dB below fundamental, details refer to following test plot, and compliance is achieved as well.

Due to the small size of the product and that there are no inductive components of significant size, 9kHz to 30MHz frequency range is not tested based on technical judgment.

Test Plot of 100kHz Bandwidth of Frequency Band Edge

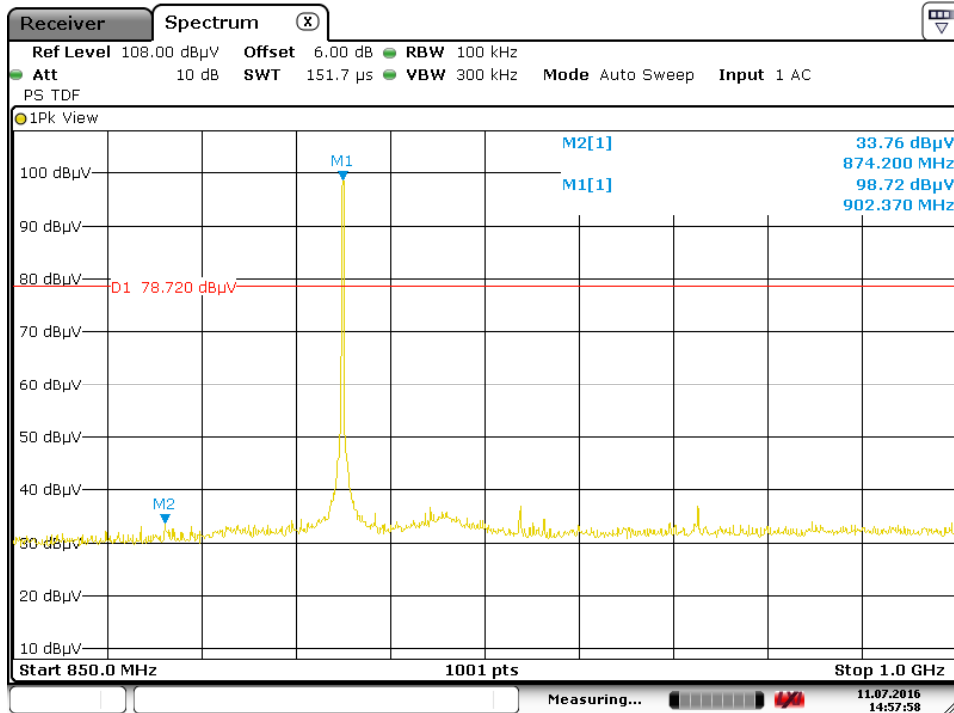
Low Channel

Horizontal



Date: 11.JUL.2016 15:00:23

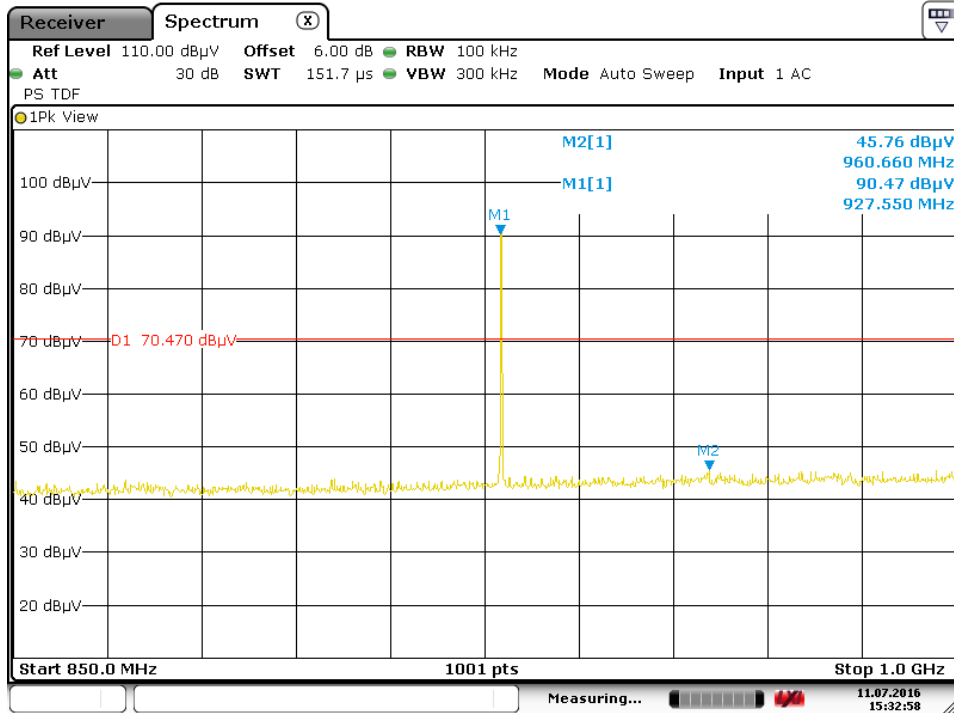
Vertical



Date: 11.JUL.2016 14:57:58

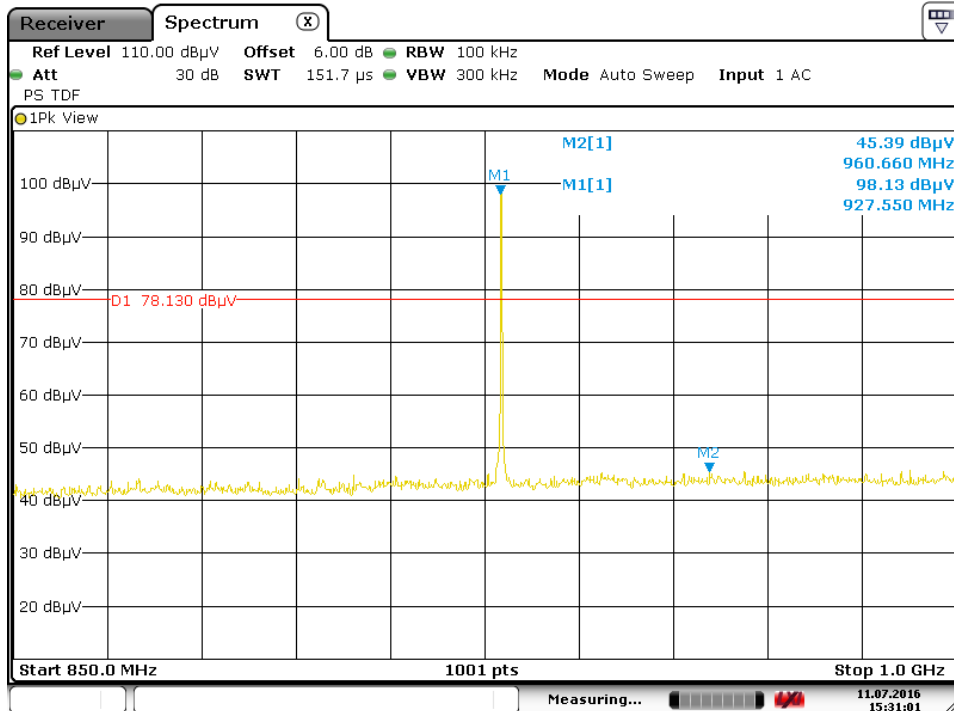
High Channel

Horizontal



Date: 11.JUL.2016 15:32:58

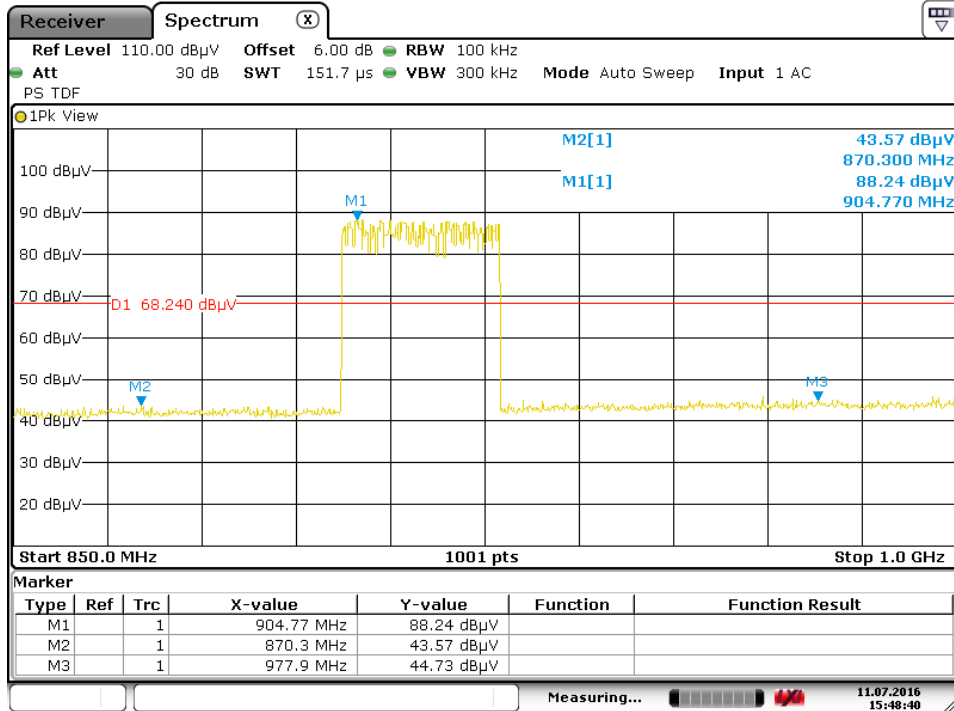
Vertical



Date: 11.JUL.2016 15:31:01

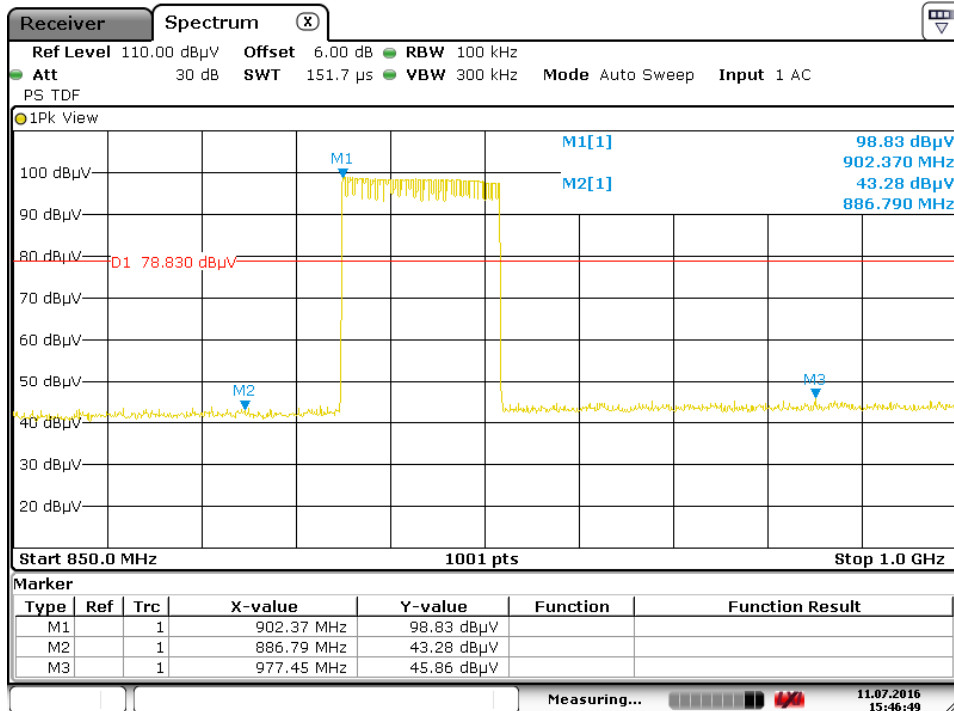
Hopping Mode

Horizontal



Date: 11.JUL.2016 15:48:40

Vertical



Date: 11.JUL.2016 15:46:49

5.1.6 Spurious Emission

RESULT:**Passed**

Test standard : FCC part 15.247(d), FCC 15.205, FCC 15.209, RSS-210 2.2, RSS-247 5.5 and RSS-Gen 8.9

Basic standard : ANSI C63.10: 2013
Limits : Radiated emissions which fall in the restricted bands, as defined in FCC 15.205(a) and RSS-210 2.7 (Table 1), must comply with the radiated emission limits specified in FCC 15.209(a) and RSS-210 2.7 (Table 2 and 3).
Emission radiated outside the specified frequency bands must comply with the -20dBc emission limits specified in FCC 15.247 and RSS-210 A8.5

Kind of test site : 3m Semi-Anechoic Chamber

Test setup

Test Channel : Low/ Middle/ High
Operation Mode : A

Remark: Testing was carried out within frequency range 30MHz to above the tenth harmonic. For details refer to Appendix D. The Radiated Emissions testing was performed in the X, Y and Z axis orientation. The worst-case Axis orientation is recorded in this test report.

5.1.7 Frequency Separation

RESULT:
Passed

Test standard : FCC part 15.247(a)(1)
 RSS-247 5.1
 Basic standard : ANSI C63.10:2013
 Limit : $\geq 20\text{dB}$ bandwidth

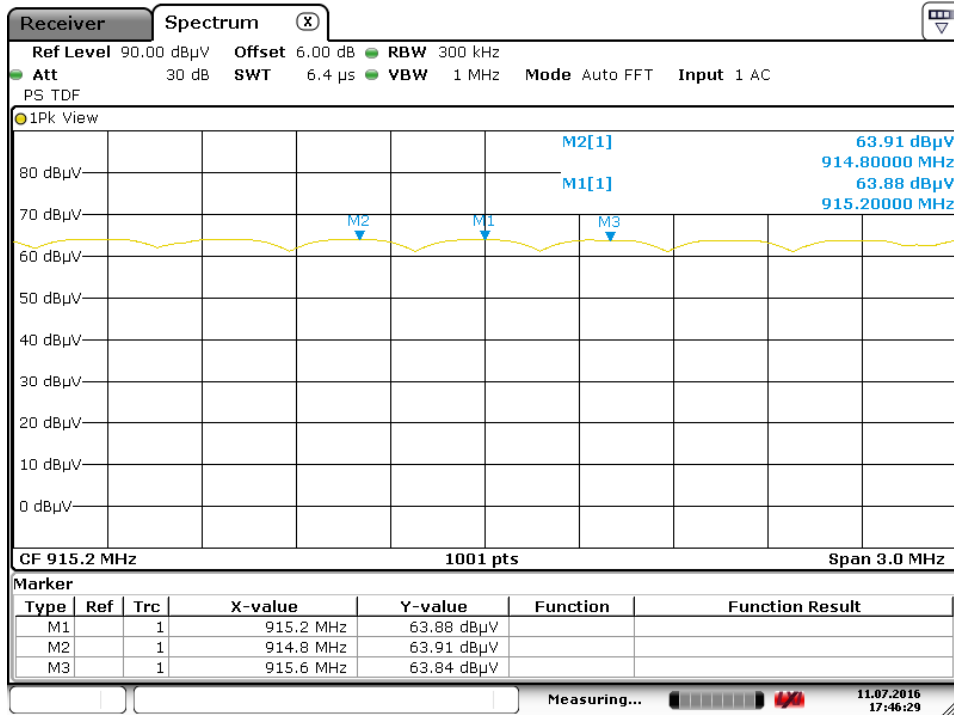
Test setup

Test Channel : Low/ Middle/ High
 Operation Mode : A
 Ambient temperature : 24°C
 Relative humidity : 53%

Table 9: Test result of Frequency Separation

Channel	Channel Frequency (MHz)	Measured Channel Separation (MHz)	Limit (kHz)	Result
Record Channel	915.2	0.4	≥ 379.6 kHz	Pass
Record Channel adj 1	914.8			
Record Channel adj 2	915.6			

Test Plot of Frequency Separation



Date: 11.JUL.2016 17:46:29

5.1.8 Number of hopping frequency

RESULT:
Passed

Test standard : FCC part 15.247(a)(1)(iii)
 RSS-247 5.1(5)
 Basic standard : ANSI C63.10:2013
 Limits : ≥ 15 non-overlapping channels
 Kind of test site : Shield room

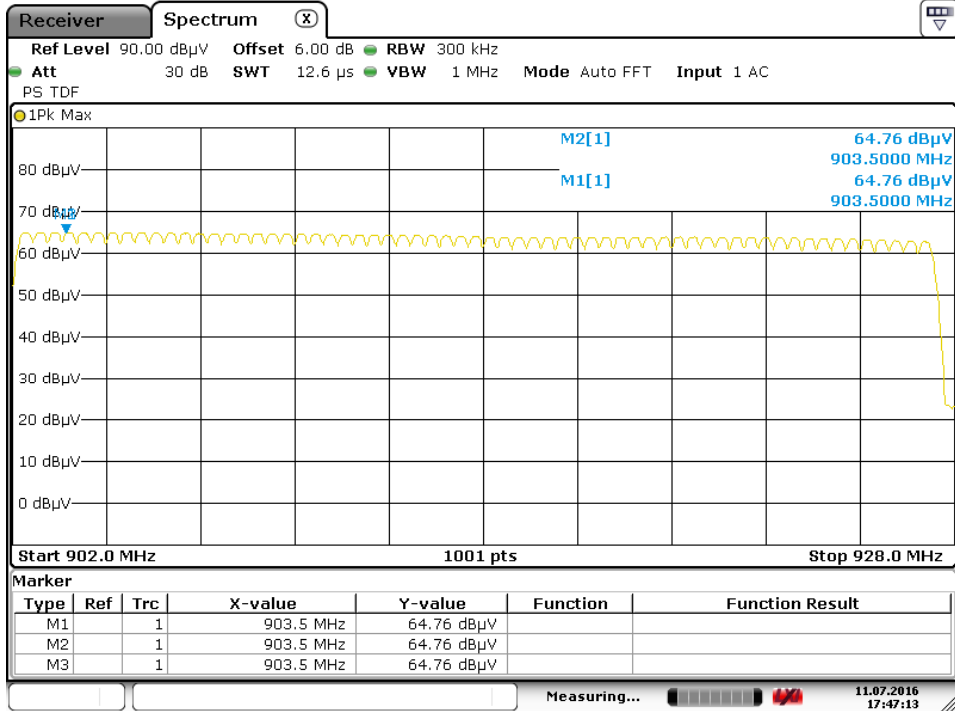
Test setup

Test Channel : Low/ Middle/ High
 Operation Mode : A
 Ambient temperature : 20-24°C
 Relative humidity : 50-65%
 Atmospheric pressure : 100-103 kPa

Table 10: Test result of Number of hopping frequency

Frequency Range	Measured Number of Hopping Channel	Limit	Result
902 to 928 MHz	63	≥ 50	Pass

Test Plot of Number of hopping frequencies



Date: 11.JUL.2016 17:47:13

5.1.9 Time of Occupancy

RESULT:**Passed**

Test standard : FCC part 15.247(a)(1)(iii)
RSS-247 5.1(5)
LP0002(2011): 3.10.1, (6.1.2)
Basic standard : ANSI C63.10:2013
LP0002(2011) Appendix II
Limits : 0.4s
Kind of test site : Shield room

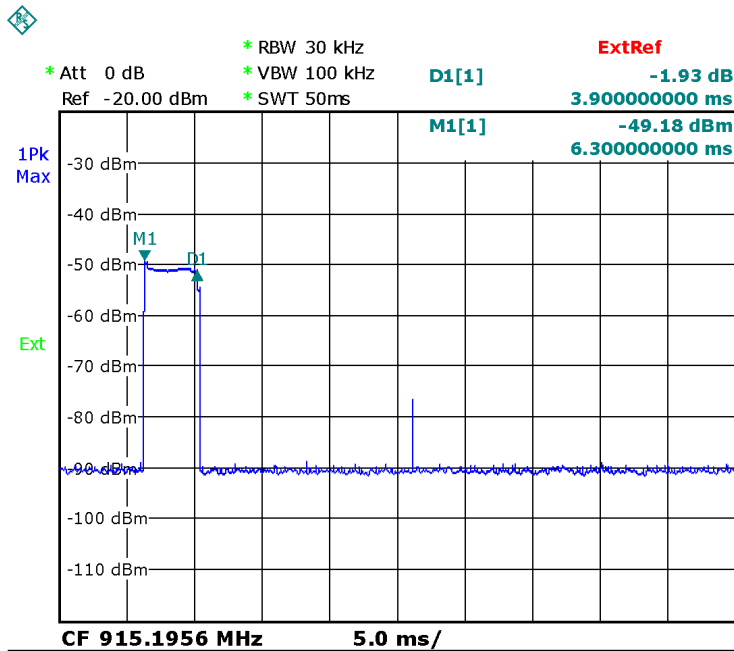
Test setup

Test Channel : Low/ Middle/ High
Operation Mode : A
Ambient temperature : 20-24°C
Relative humidity : 50-65%
Atmospheric pressure : 100-103 kPa

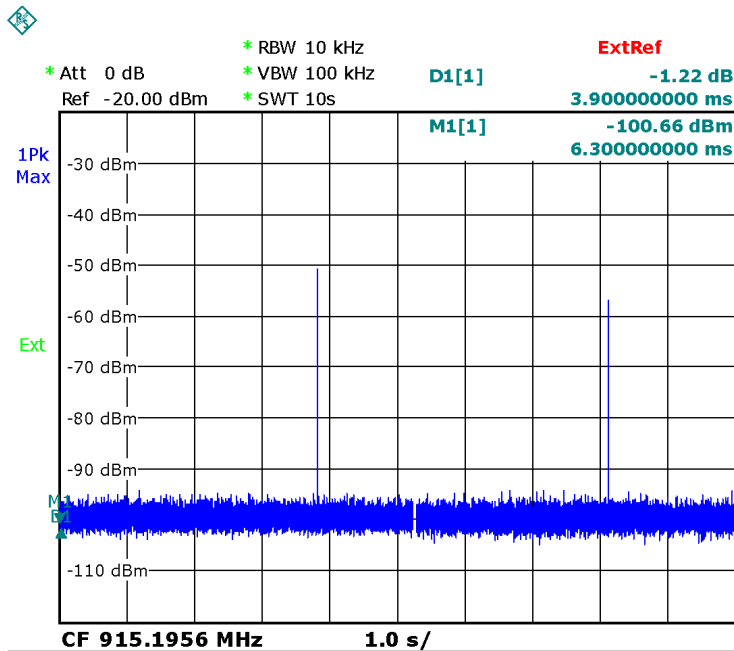
Dwell Time: $T_{on} + T_{off} = 100\text{ms}$ $T_{on} = 3.9\text{ ms}$

Duty Cycle: 3.9 %
Duty Cycle Correction: -28 dB

Test Plot of Time of Occupancy



Date: 6.DEC.2016 08:38:55



Date: 6.DEC.2016 09:06:42

-> less than 400ms within 10 sec.

6. List of Tables

Table 1: Applied Standard and Test Levels	4
Table 2: List of Test and Measurement Equipment	6
Table 3: Emission Measurement Uncertainty.....	7
Table 4: Basic Information of EUT	8
Table 5: Technical Specification of EUT	8
Table 6: Test result of Peak Output.....	15
Table 7: Test result of 20dB Bandwidth,	16
Table 8: Test result of 99% Bandwidth, GFSK modulation	19
Table 9: Test result of Frequency Separation	27
Table 10: Test result of Number of hopping frequency	29