

ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

INTENTIONAL RADIATOR CERTIFICATION TO FCC PART 15 SUBPART C AND ISED RSS-210 REQUIREMENT

OF

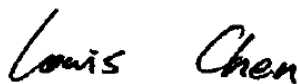
Applicant: Honeywell International Inc.
 9680 Old Bailes Road, Fort Mill, SC 29707, USA
Product Name: Vehicle Mount Computer
Brand Name: Honeywell
Model No.: VM1A-L0N
Model Difference: N/A
Report Number: ER/2018/90028
FCC ID HD5-VM1AL0N
IC: 1693B-VM1AL0N
FCC Rule Part Part 15.225
IC Rule: RSS-210 issue 9 Annex B B.6 Nov. 2017
Issue Date: Oct. 05, 2018
Date of Test: Sep. 12, 2018 ~ Oct. 02, 2018
Date of EUT Received: Sep. 04, 2018

We hereby certify that:

The above equipment was tested by SGS Taiwan Ltd. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.10:2013 and the energy emitted by the sample EUT tested as described in this report is in compliance with conducted and radiated emission limits of FCC Rules Part 15.225 and ISED RSS-210.

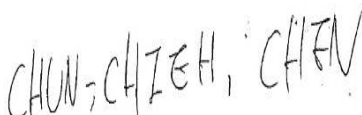
The test results of this report relate only to the tested sample identified in this report.

Tested By:



Louis Chen / Sr. Engineer

Approved By:



CHUN-CHIEH CHEN / Asst.
Supervisor

Testing Laboratory
0513

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Revision History

Report Number	Revision	Description	Effected Page	Issue Date	Revised By
ER/2018/90028	Rev.00	Initial creation of document	All	Oct. 05, 2018	Elle Chang

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Table of Contents

1 GENERAL INFORMATION	4
2 SYSTEM TEST CONFIGURATION	6
3 SUMMARY OF TEST RESULTS	10
4 DESCRIPTION OF TEST MODES.....	10
5 MEASUREMENT UNCERTAINTY	11
6 CONDUCTED EMISSIONS TEST	12
7 RADIATED TEST ITEMS	15
8 FREQUENCY TOLERANCE.....	28
9 20 dB & 99% OCCUPIED BANDWIDTH MEASUREMENT	32
10 ANTENNA REQUIREMENT	34

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1 GENERAL INFORMATION

1.1 Product Description

General:

Product Name:	Vehicle Mount Computer	
Brand Name:	Honeywell	
Model No.:	VM1A-L0N	
Model Difference:	N/A	
Product HW/SW version:	VM1AL0N / 85.00.00-0322	
Radio HW/SW version:	V1.0 / V5.1.1.28U	
Power Supply:	10.8Vdc from Rechargeable Li-ion Battery or 15Vdc from AC/DC Adapter.	
	Battery:	Model No.: 163176-0001 Rev C / OVT310L1R00 C, Supplier: TOTEX
	Adapter:	Model No.: GT-46600-6015-T3, Supplier: GlobTek, Inc.

NFC:

Operating Frequency	13.56MHz
Transmit Power	< 123dBuV/m at 3m.
Number of Channels	1
Antenna Type	Loop Antenna
Modulation Type	ASK

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1.2 Test Methodology

FCC Part 15, Subpart C §15.225
 FCC Part 15, Subpart C §15.225
 RSS-210 issue 9 Annex B B.6 Nov. 2017
 RSS-Gen. issue 5 Apr. 2018
 ANSI C63.10:2013

Note: All test items have been performed and record as per the above standards..

1.3 Test Facility

SGS Taiwan Ltd. Electronics & Communication Laboratory No.134, Wu Kung Road, New Taipei Industrial Park, Wuku District, New Taipei City, Taiwan 24803 (TAF code 0513)

FCC Registration Number and Designation number are: 509634 / TW0001

Canada Registration Number: 4620A-4

1.4 Special Accessories

AC Adapter is used while the test is conducted and there is no other accessory attached. This is the worst case condition.

1.5 Equipment Modifications

There was no modification incorporated into the EUT.

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2 SYSTEM TEST CONFIGURATION

2.1 EUT Configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner which intends to maximize its emission characteristics in a continuous normal application.

2.2 EUT Exercise

The Transmitter was operated in the normal operating mode. the Tx frequency was fixed which was for the purpose of the measurements.

2.3 Test Procedure

2.3.1 Conducted Emissions

The EUT is a placed on as turn table which is 0.8m above ground plane. Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz,. The CISPR Quasi-Peak and Average detector mode is employed according to §15.107. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.

2.3.2 Radiated Emissions

The EUT is a placed on as turn table. For emissions testing at or below 1 GHz, the table height shall be 0.8 m above the reference ground plane. For emission measurements above 1 GHz, the table height shall be 1.5 m above the reference ground plane. The turn table shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the max. emission, the relative positions of this transmitter (EUT) was rotated through three orthogonal axes and measurement procedures for electric field radiated emissions above 1 GHz the EUT measurement is to be made "while keeping the antenna in the 'cone of radiation' from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response." is still within the 3dB illumination BW of the measurement antenna.

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2.4 Limitation

(1) Conducted Emission

According to FCC Part 15.207(a) & RSS-Gen section 8.8 Conducted Emission Limits is as following.

Frequency range MHz	Limits dB (uV)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5	56	46
5 to 30	60	50
Note 1.The lower limit shall apply at the transition frequencies 2.The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.		

(2) Radiated Emission

- The field strength of any emission within the band 13.553-13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters.
- Within the bands 13.410-13.553 MHz and 13.567-13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.
- Within the bands 13.110-13.410 MHz and 13.710-14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.
- The field strength of any emissions appearing outside of the 13.110-14.010 MHz shall not exceed the general radiated emission limits in section 15.209 as below.

Frequency (MHz)	Field strength $\mu\text{V}/\text{m}$	Distance (m)	Field strength at 3m $\text{dB}\mu\text{V}/\text{m}$
1.705-30	30	30	69.54
30-88	100	3	40
88-216	150	3	43.5
216-960	200	3	46
Above 960	500	3	54

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- Remark 1. Emission level in dBuV/m= $20 \log (\mu\text{V}/\text{m})$
: 2. Measurement was performed at an antenna to the closed point of EUT distance of meters.
3. Distance extrapolation factor = $40 \log (\text{required distance}/ \text{test distance})$ (dB);
4. The measurement was undertaken in closer distance at 3m, where extrapolation factor is offset to convert the limit of the measurement.
Ex. $20 \log (30)+40 \log (30 / 3)=69.54 \text{ dBuV} / \text{m}$
5. Only spurious frequency is permitted to locate within the Restricted Bands specified in provision of §15.205.
6. The general radiated emission limits in §15.209 apply for the spurious emission generate from UE, except for the fundamental emission where the respective section specifies otherwise.

(3) Frequency Tolerance

The frequency tolerance of the carrier signal shall be maintained within +/- 0.01% of the operating frequency over a temperature variation of -20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

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2.5 Configuration of Tested System

Fig. 2-1 Emission test set up configuration

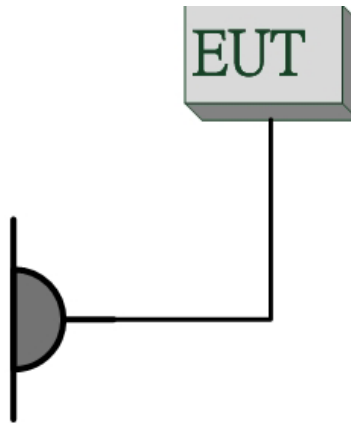


Table 2-1 Equipment Used in Tested System

Item	Equipment	Mfr/Brand	Model/Type No.	Series No.	Data Cable	Power Cord
1.	NFC Test software	N/A	N/A	N/A	N/A	N/A

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3 SUMMARY OF TEST RESULTS

FCC Rules	IC Rules	Description Of Test	Result
§15.207	RSS-Gen § 8.8	AC Power Line Conducted Emission	Compliant
§15.225 (a)-(d)	RSS210 Annex B B.6	Radiated Emission	Compliant
§15.209	RSS-Gen § 8.9	Radiated Emission Limits, general requirement	Compliant
§15.225 (e)	RSS-Gen § 8.11	Frequency Stability	Compliant
§2.1049 §15.215 (c)	RSS-Gen § 6.7	20 dB & 99% OCCUPIED BANDWIDTH	Compliant
§15.203	RSS-Gen § 6.8	Antenna Requirement	Compliant

4 DESCRIPTION OF TEST MODES

4.1 The Worst Test Modes and Channel Details

1. The EUT stay in continuous transmission mode.
2. The frequency 13.56 MHz is the default channel to test, where it is the only manipulative channel as this application supports.
3. Only one configuration is supported/applicable as follows.

RADIATED EMISSION TEST			
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION
NFC	1	1	ASK
FREQUENCY STABILITY			
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION
NFC	1	1	ASK
20dB BANDWIDTH			
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION
NFC	1	1	ASK

The field strength of spurious radiation emission was measured as EUT stand-up position (H, E1 mode) and lie down position (E2 mode) for NFC Transmitter for channel the worst case E2 position was reported.

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5 MEASUREMENT UNCERTAINTY

Test Items	Uncertainty
AC Power Line Conducted Emission	+/- 2.586 dB
Frequency Stability	+/- 123.36 Hz
20 dB OCCUPIED BANDWIDTH	+/- 123.36 Hz
Temperature	+/- 0.8 °C
Humidity	+/- 4.7 %
DC / AC Power Source	DC= +/- 1%, AC=+/- 0.2%

Radiated Spurious Emission:

Measurement uncertainty (Polarization : Vertical)	9kHz - 30MHz: +/- 2.3dB
	30MHz - 180MHz: +/- 3.37dB
	180MHz -417MHz: +/- 3.19dB
	0.417GHz-1GHz: +/- 3.19dB

Measurement uncertainty (Polarization : Horizontal)	9kHz - 30MHz: +/- 2.3dB
	30MHz - 167MHz: +/- 4.22dB
	167MHz -500MHz: +/- 3.44dB
	0.5GHz-1GHz: +/- 3.39dB

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

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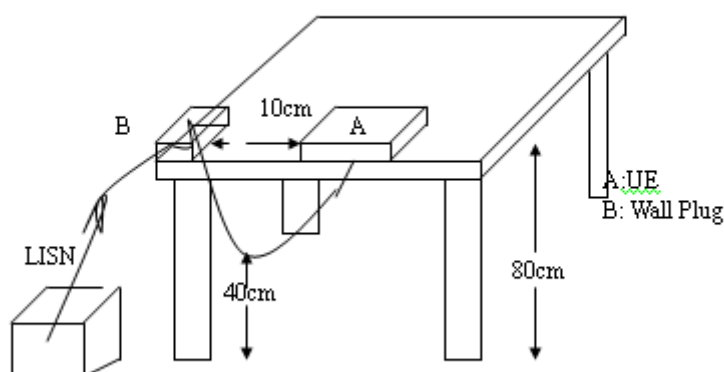
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6 CONDUCTED EMISSIONS TEST

6.1 Measurement Procedure:

1. The EUT was placed on a table which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. Sweep frequency starting from 150 kHz to 30 MHz for phase L1.
4. Repeating the measurement as lists above for phase neutral.

6.2 Test SET-UP (Block Diagram of Configuration)



6.3 Measurement Equipment Used:

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
EMI Test Receiver	R&S	ESC17	100335	02/02/2018	02/01/2019
LISN	SCHWARZBECK	NSLK 8127	8127-649	05/18/2018	05/17/2019

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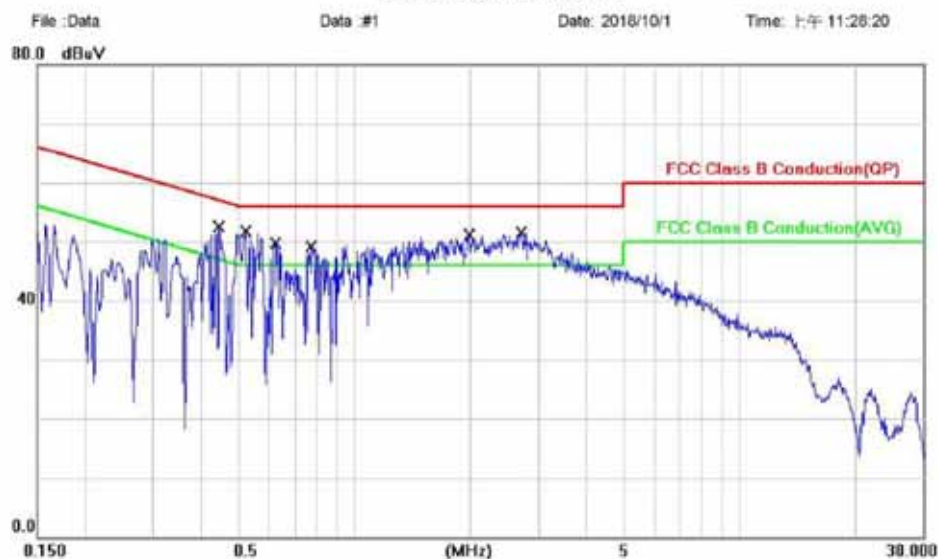
6.4 Measurement Result:

AC POWER LINE CONDUCTED EMISSION TEST DATA

Operation Mode:	Operation mode	Test By:	Jerry
-----------------	----------------	----------	-------

Site: Conduction Room	Phase: L1	Temperature: 25 °C
Limit: FCC Class B Conduction(QP)	Power: AC 120V/60Hz	Humidity: 85 %
Mode: Operation		
Note: Adapter: GT-46600-6015-T3		

Conducted Emission



No.	Mk.	Freq.	Reading	Correct	Measure-	Limit	Over		
		MHz	dBuV	Factor	ment	dBuV	dB	Detector	Comment
1	*	0.4460	50.90	0.04	50.94	56.95	-6.01	QP	
2		0.4460	39.50	0.04	39.54	46.95	-7.41	AVG	
3		0.5220	49.30	0.04	49.34	56.00	-6.66	QP	
4		0.5220	34.00	0.04	34.04	46.00	-11.96	AVG	
5		0.6220	48.50	0.04	48.54	56.00	-7.46	QP	
6		0.6220	37.10	0.04	37.14	46.00	-8.86	AVG	
7		0.7740	47.50	0.05	47.55	56.00	-8.45	QP	
8		0.7740	36.10	0.05	36.15	46.00	-9.85	AVG	
9		1.9860	46.80	0.06	46.86	56.00	-9.14	QP	
10		1.9860	37.20	0.06	37.26	46.00	-8.74	AVG	
11		2.7140	45.80	0.09	45.89	56.00	-10.11	QP	
12		2.7140	38.00	0.09	38.09	46.00	-7.91	AVG	

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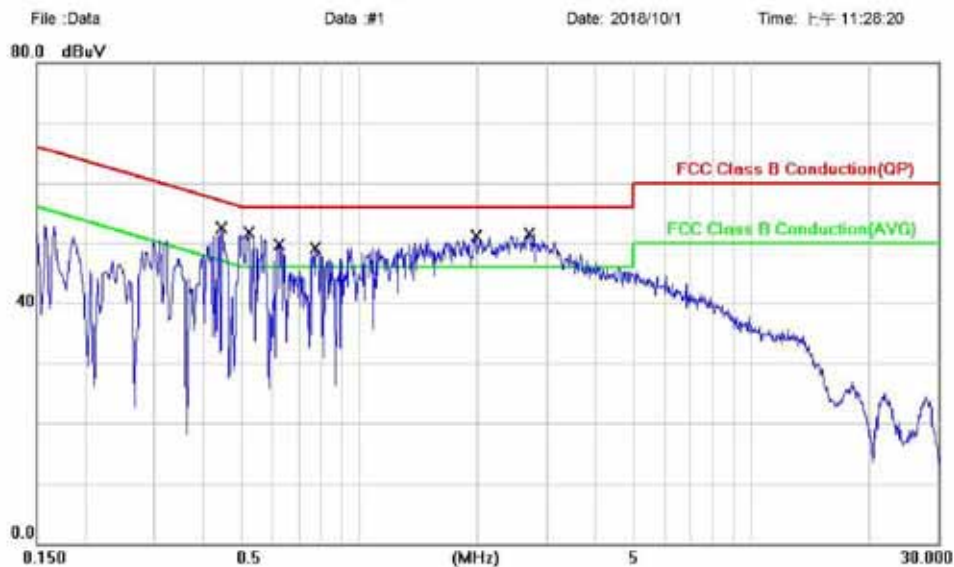
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Site: Conduction Room
Limit: FCC Class B Conduction(QP)
Mode: Operation
Note: Adapter: GT-46600-6015-T3

Phase: L1
Power: AC 120V/60Hz

Temperature: 25 °C
Humidity: 85 %

Conducted Emission



No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Detector	Comment
		MHz	dBuV	dB	dBuV	dBuV	dB		
1	*	0.4460	50.90	0.04	50.94	56.95	-6.01	QP	
2		0.4460	39.50	0.04	39.54	46.95	-7.41	AVG	
3		0.5220	49.30	0.04	49.34	56.00	-6.66	QP	
4		0.5220	34.00	0.04	34.04	46.00	-11.96	AVG	
5		0.6220	48.50	0.04	48.54	56.00	-7.46	QP	
6		0.6220	37.10	0.04	37.14	46.00	-8.86	AVG	
7		0.7740	47.50	0.05	47.55	56.00	-8.45	QP	
8		0.7740	36.10	0.05	36.15	46.00	-9.85	AVG	
9		1.9860	46.80	0.06	46.86	56.00	-9.14	QP	
10		1.9860	37.20	0.06	37.26	46.00	-8.74	AVG	
11		2.7140	45.80	0.09	45.89	56.00	-10.11	QP	
12		2.7140	38.00	0.09	38.09	46.00	-7.91	AVG	

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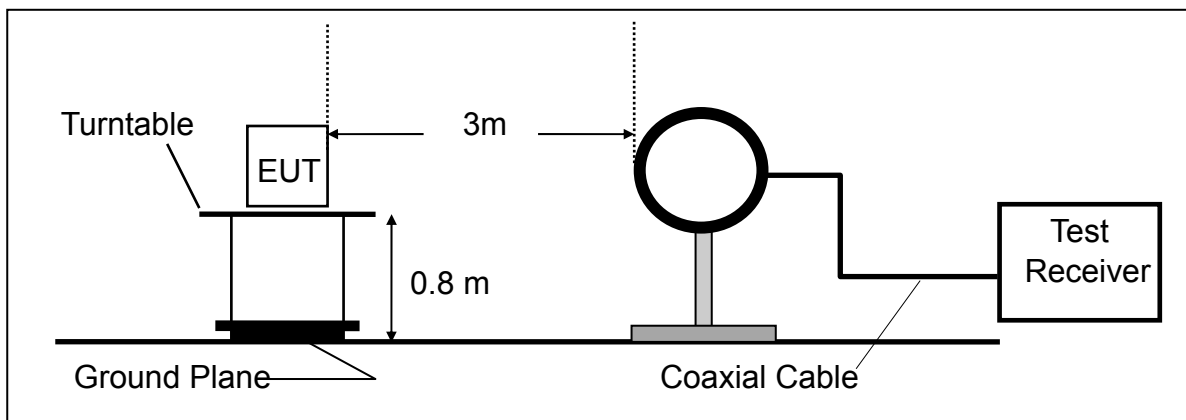
7 RADIATED TEST ITEMS

7.1 Measurement Procedure

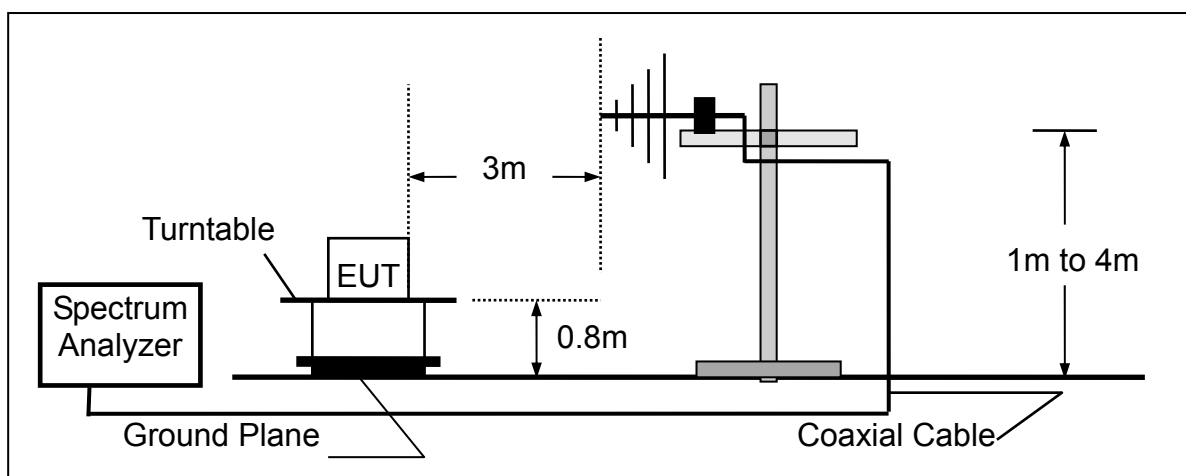
1. Configure the EUT according to ANSI C63.10.
2. The EUT was placed on a turn table which is 0.8m above ground plane and been measured in the frequency range between 0.009MHz to 30MHz and 30MHz to 1GHz.
3. The turn table shall rotate 360 degrees to determine the position of maximum emission level.
4. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emission.
5. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
6. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
7. Repeat above procedures until all default test channel measured were complete.

7.2 Test SET-UP (Block Diagram of Configuration)

(A) Radiated Emission Test Set-Up, Frequency Below 30MHz



(B) Radiated Emission Test Set-Up, Frequency Below 1000MHz



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7.3 Measurement Equipment Used:

SGS 966 Chamber No.C					
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
Bi-log Antenna	SCHWAZBEC K	VULB9168	378	12/29/2017	12/28/2018
Loop Antenna	ETS.LINDGR EN	6502	148045	09/25/2018	09/24/2019
3m Site NSA	SGS	966 chamber	N/A	01/02/2018	01/01/2019
Spectrum Analyzer	Agilent	E4446A	MY51100003	05/15/2018	05/14/2019
EMI Test Receiver	R&S	ESC17	100335	02/02/2018	02/01/2019
Pre-Amplifier	HP	8447D	2944A07676	01/02/2018	01/01/2019
Low Loss Cable	Huber Suhner	966_RX	9	01/02/2018	01/01/2019

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7.4 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor (if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CL - AG$$

Where FS = Field Strength	CL = Cable Attenuation Factor (Cable Loss)
RA = Reading Amplitude	AG = Amplifier Gain
AF = Antenna Factor	

7.5 Field Strength of Fundamental Emission

7.5.1 FCC Applicable standard

Rules and specifications	CFR 47 Part 15 section 15.225(a)-(d)		
Frequency of Emission (MHz)	Field Strength (μV/m) at 30m	Field Strength (dBμV/m) at 30m	Field Strength (dBμV/m) at 3m
1.705~13.110	30	29.5	69.5
13.110~13.410	106	40.5	80.5
13.410~13.553	334	50.5	90.47
13.553~13.567	15848	84	124
13.567~13.710	334	50.5	90.47
13.710~14.010	106	40.5	80.5
14.010~30.00	30	29.5	69.5

Field strength of fundamental emissions limit:

The field strength of fundamental emissions shall not exceed 15848 microrvolts/meter at 30 meters. The Limit is converted to 124.00dBuV/m by offsetting the distance extrapolation factor as measurement distance is taken place at 3 meters.

$$\text{Distance extrapolation} = 40 \cdot \log(30/3) = 40 \text{ dB}$$

30m to 3m

$$\text{Distance extrapolation} = 40 \cdot \log(30/3) = 40 \text{ dB}$$

$$\text{Limit is re-adjusted in terms of limit taken in 3m} = 20 \cdot \log(15848 \text{ uV/m}) + 40 = 124.00\text{dBuV/m}$$

30m to 10m

$$\text{Distance extrapolation} = 40 \cdot \log(30/10) = 19.08 \text{ dB}$$

$$\text{Limit is re-adjusted in terms of limit taken in 3m} = 20 \cdot \log(15848 \text{ uV/m}) + 19.08 = 103.08\text{dBuV/m}$$

10m to 3m

$$\text{Distance extrapolation} = 40 \cdot \log(10/3) = 20.92 \text{ dB}$$

$$\text{Limit is re-adjusted in terms of limit taken in 3m} = 20 \cdot \log(15848 \text{ uV/m}) + 20.92 = 104.92\text{dBuV/m}$$

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7.5.2 ISED Applicable standard

Radiated Mask for RSS 210 Annex B B6

- (a) 15.848 millivolts/m (84 dB μ V/m) at 30 m, within the band 13.553-13.567 MHz.
- (b) 334 microvolts/m (50.5 dB μ V/m) at 30 m, within the bands 13.410-13.553 MHz and 13.567-13.710 MHz.
- (c) 106 microvolts/m (40.5 dB μ V/m) at 30 m, within the bands 13.110-13.410 MHz and 13.710-14.010 MHz.
- (d) RSS-Gen general field strength limits for frequencies outside the band 13.110-14.010 MHz.

Distance extrapolation = $40 \cdot \log(30/3) = 40 \text{ dB}$

Limit is re-adjusted in terms of limit taken in 3m for the following frequency segment of the interest:

- a) $20 \cdot \log(15848 \text{ uV/m}) + 40 \text{ dB} = 124.00 \text{ dBuV/m}$
- b) $20 \cdot \log(334 \text{ uV/m}) + 40 \text{ dB} = 90.47 \text{ dBuV/m}$
- c) $20 \cdot \log(106 \text{ uV/m}) + 40 \text{ dB} = 80.50 \text{ dBuV/m}$

Note:

1. Emission level in dBuV/m = $20 \log(\mu\text{V/m})$
2. Distance extrapolation factor = $40 \log(\text{required distance}/\text{test distance}) \text{ (dB)}$
3. The lower limit shall apply at the transition frequencies.
4. The measurement was undertaken in closer distance below 30MHz at 10m and 3m and above 30MHz at 3m, where extrapolation factor is offset to convert the limit of the measurement.
5. KDB 414788 D01 OATS and 3m semi-anechoic chamber Justification:
Base on FCC 15.31 (f) (2): measurements may be performed at a distance closer than that specified in the regulations; however, an attempt should be made to avoid making measurements in the near field. OATS and 3m SAC chamber testing had been performed and 3m SAC measured test result is the worst case test result.
6. Emission level in dBuV/m = $20 \log(\mu\text{V/m})$
7. Distance extrapolation factor = $40 \log(\text{required distance}/\text{test distance}) \text{ (dB)}$
8. The lower limit shall apply at the transition frequencies.
9. The measurement was undertaken in closer distance at 3m, where extrapolation factor is offset to convert the limit of the measurement.

Actual FS(dB μ V/m) = Spectrum. Reading level(dB μ V) + Factor(dB)

Factor(dB) = Antenna Factor(dB μ V/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

The trace on RE(radiation emission) plot is as colored blue, and the detection manner we've employed is peak detector.

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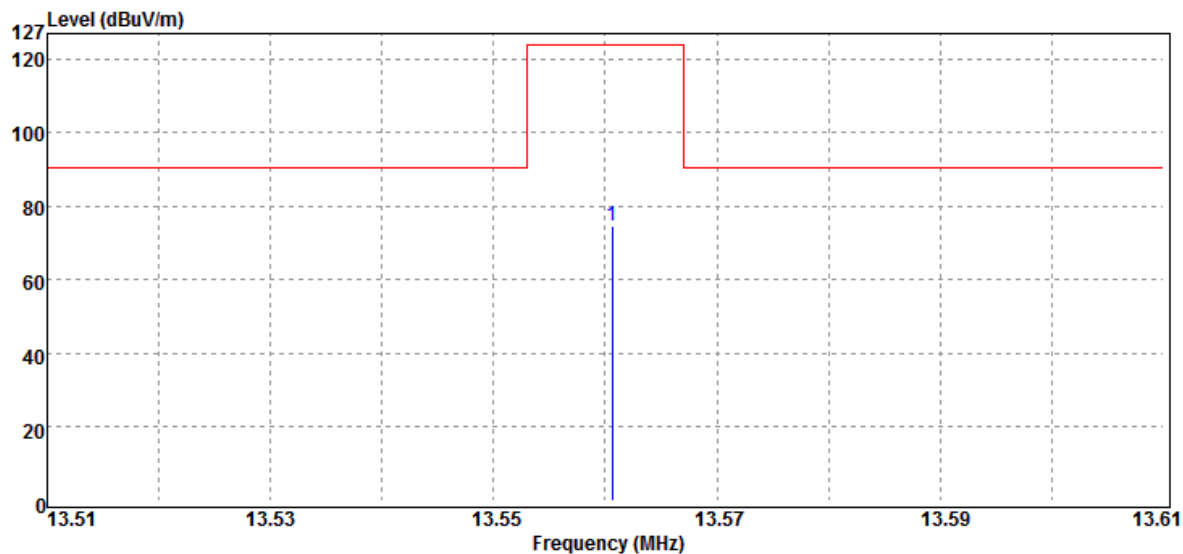
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7.6 Field Strength of Fundamental Emission Measurement Result

Operation Band	:NFC	Test Date	:2018-10-02
Fundamental Frequency	:13.56 MHz	Temp./Humi.	:21 deg_C / 62 RH
Operation Mode	:MAIN	Engineer	:Wei
EUT Pol.	:E2 Plane	Measurement Antenna Pol.	:VERTICAL



Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	Mode	Reading Level	dB	FS	@3m	dB
	PK/QP/AV	dBμV		dBμV/m	dBμV/m	
13.56	Peak	62.99	11.52	74.51	123.90	-49.39

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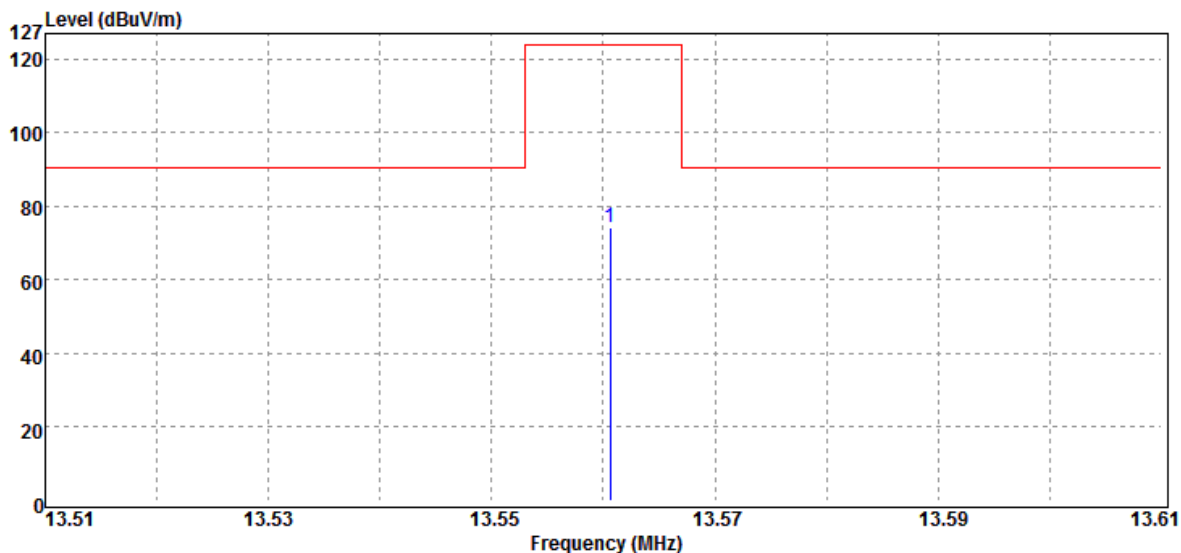
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Operation Band :NFC
Fundamental Frequency :13.56 MHz
Operation Mode :MAIN
EUT Pol. :E2 Plane

Test Date :2018-10-02
Temp./Humi. :21 deg_C / 62 RH
Engineer :Wei
Measurement Antenna Pol. :HORIZONTAL



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
13.56	Peak	62.94	11.52	74.46	123.90	-49.44

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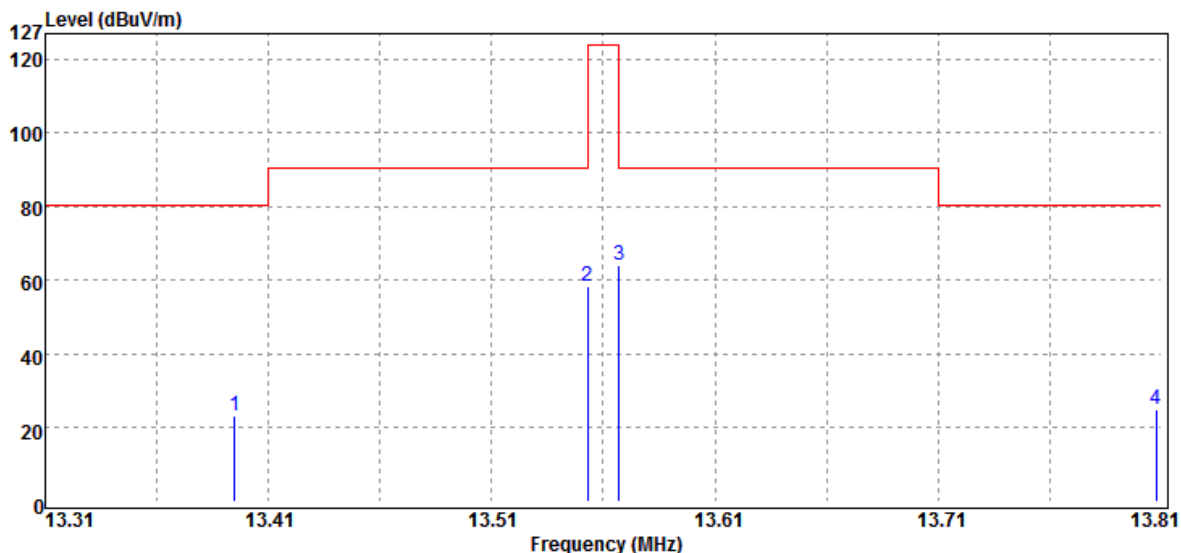
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7.6.1 Radiated Mask

Operation Band :NFC
Fundamental Frequency :13.56 MHz
Operation Mode :MASK
EUT Pol. :E2 Plane

Test Date :2018-10-02
Temp./Humi. :21 deg_C / 62 RH
Engineer :Wei
Measurement Antenna Pol. :VERTICAL



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
13.40	Peak	11.64	11.52	23.16	80.50	-57.34
13.55	Peak	46.94	11.52	58.46	90.47	-32.01
13.57	Peak	52.50	11.52	64.02	90.47	-26.45
13.81	Peak	13.54	11.53	25.07	80.50	-55.43

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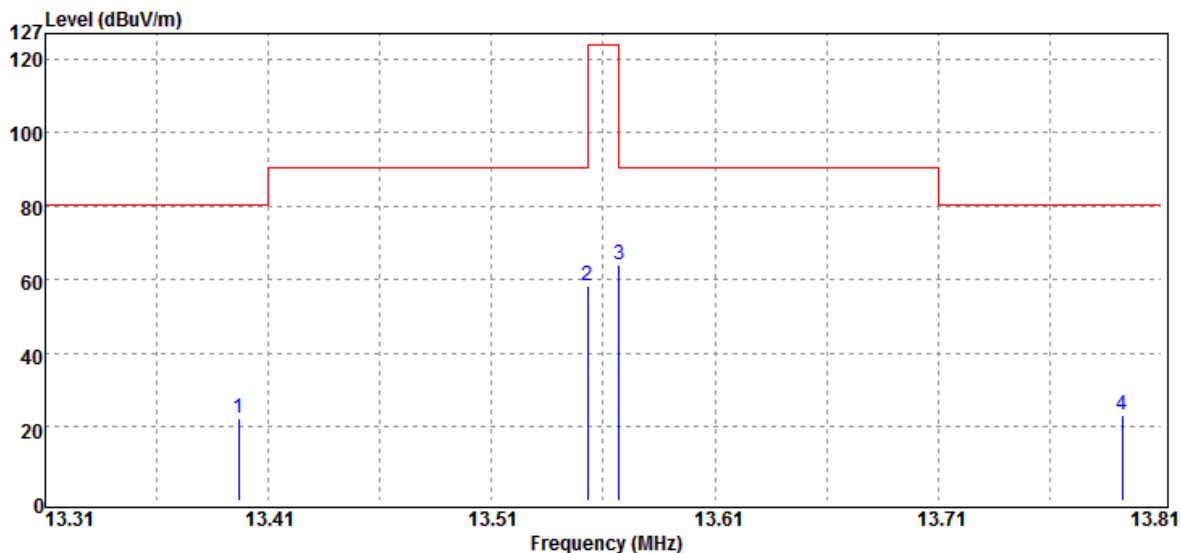
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Operation Band :NFC
Fundamental Frequency :13.56 MHz
Operation Mode :MASK
EUT Pol. :E2 Plane

Test Date :2018-10-02
Temp./Humi. :21 deg_C / 62 RH
Engineer :Wei
Measurement Antenna Pol. :HORIZONTAL



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
13.40	Peak	10.78	11.52	22.30	80.50	-58.20
13.55	Peak	46.95	11.52	58.47	90.47	-32.00
13.57	Peak	52.45	11.52	63.97	90.47	-26.50
13.79	Peak	11.92	11.53	23.45	80.50	-57.05

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7.7 Radiated Emission Measurement

7.7.1 Standard Applicable

The field strength of any emission which appear outside of 13.553~13.567MHz Band shall not exceed the general radiated emissions limits.

Frequency (MHz)	Field strength (μV/m)	Distance (meters)
0.009~0.490	2400/F(kHz)	300
0.490~1.705	24000/F(kHz)	30
1.705-30	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Note:

1. Emission level in dBμV/m=20 log (μV/m)
2. Distance extrapolation factor = 40 log (required distance/ test distance) (dB)
3. $20 \cdot \log(30 \mu\text{V/m}) + 40\text{dB} = 69.54 \text{ dBuV/m}$
4. The lower limit shall apply at the transition frequencies.
5. The measurement was undertaken in closer distance at 3m, where extrapolation factor is offset to convert the limit of the measurement.

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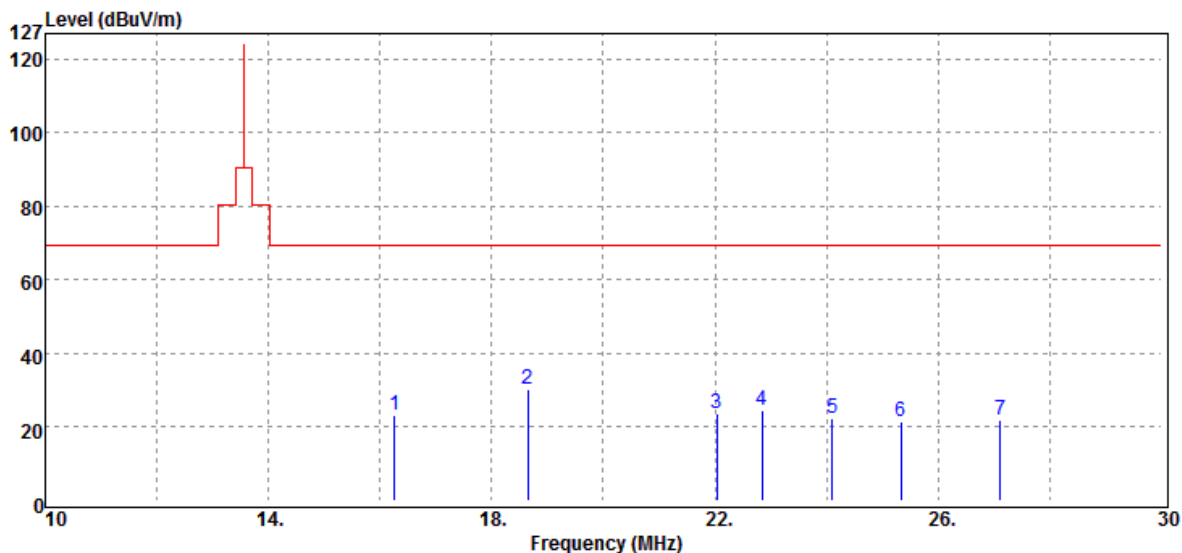
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Operation Band :NFC
Fundamental Frequency :13.56 MHz
Operation Mode :Tx
EUT Pol. :E2 Plane

Test Date :2018-09-27
Temp./Humi. :21 deg_C / 62 RH
Engineer :Wei
Measurement Antenna Pol. :VERTICAL



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
16.26	Peak	11.89	11.58	23.47	69.54	-46.07
18.64	Peak	18.59	11.64	30.23	69.54	-39.31
22.04	Peak	12.77	11.11	23.88	69.54	-45.66
22.84	Peak	13.50	10.90	24.40	69.54	-45.14
24.10	Peak	11.81	10.60	22.41	69.54	-47.13
25.34	Peak	11.31	10.32	21.63	69.54	-47.91
27.12	Peak	12.18	9.94	22.12	69.54	-47.42

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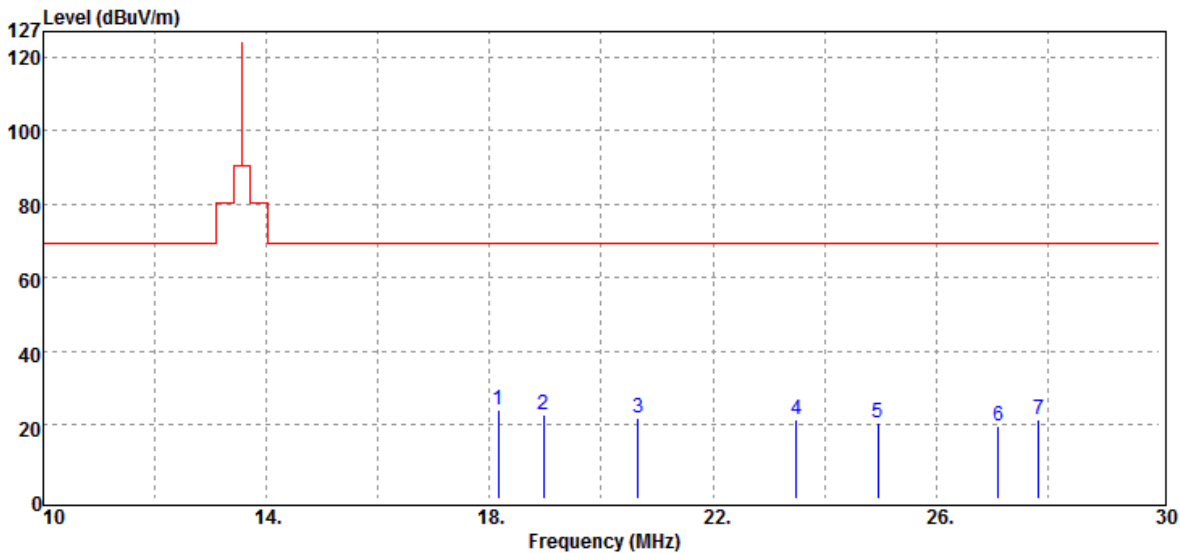
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Operation Band :NFC
Fundamental Frequency :13.56 MHz
Operation Mode :Tx
EUT Pol. :E2 Plane

Test Date :2018-09-27
Temp./Humi. :21 deg_C / 62 RH
Engineer :Wei
Measurement Antenna Pol. :HORIZONTAL



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
18.16	Peak	12.33	11.63	23.96	69.54	-45.58
18.96	Peak	10.98	11.65	22.63	69.54	-46.91
20.66	Peak	10.58	11.48	22.06	69.54	-47.48
23.50	Peak	10.60	10.74	21.34	69.54	-48.20
24.96	Peak	10.25	10.40	20.65	69.54	-48.89
27.12	Peak	10.04	9.94	19.98	69.54	-49.56
27.84	Peak	11.96	9.79	21.75	69.54	-47.79

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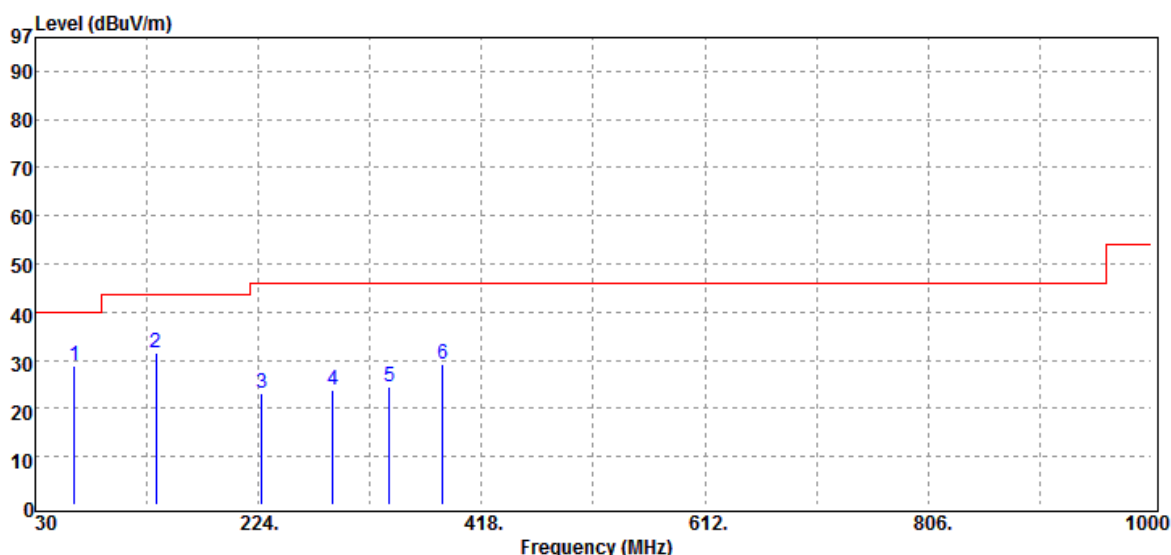
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Test Date :2018-09-27
Temp./Humi. :21 deg_C / 62 RH
Engineer :Wei
Measurement Antenna Pol. :VERTICAL



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
63.95	Peak	37.67	-8.75	28.92	40.00	-11.08
134.76	Peak	40.02	-8.55	31.47	43.50	-12.03
226.91	Peak	31.83	-8.72	23.11	46.00	-22.89
288.99	Peak	29.64	-5.86	23.78	46.00	-22.22
337.49	Peak	29.44	-4.85	24.59	46.00	-21.41
384.05	Peak	32.94	-3.79	29.15	46.00	-16.85

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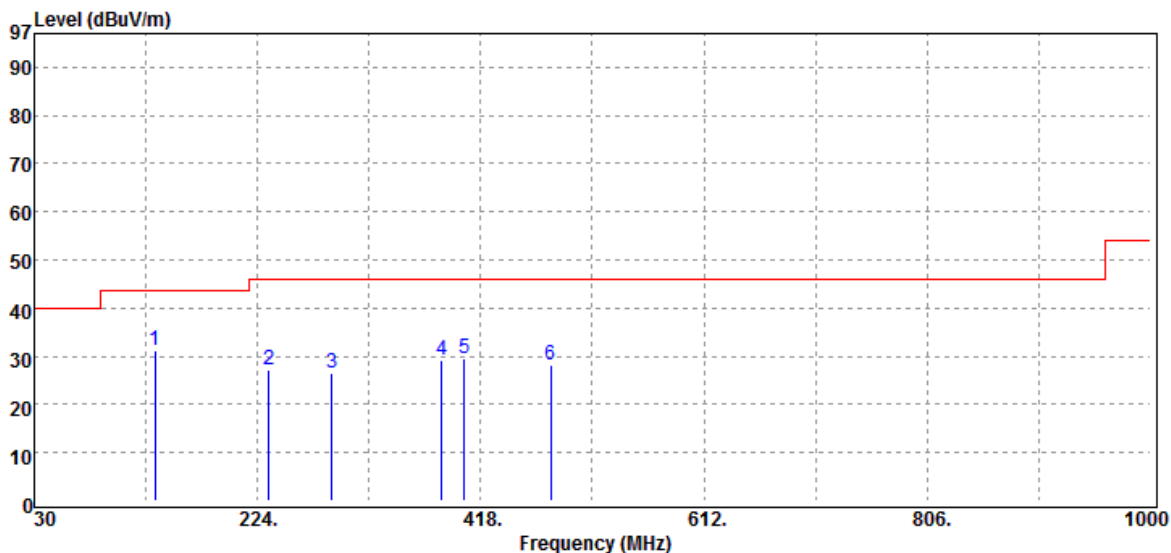
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Test Date :2018-09-27
Temp./Humi. :21 deg_C / 62 RH
Engineer :Wei
Measurement Antenna Pol. :HORIZONTAL



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
134.76	Peak	39.89	-8.55	31.34	43.50	-12.16
233.70	Peak	35.29	-8.24	27.05	46.00	-18.95
288.99	Peak	32.29	-5.86	26.43	46.00	-19.57
384.05	Peak	33.03	-3.79	29.24	46.00	-16.76
403.45	Peak	32.59	-3.07	29.52	46.00	-16.48
479.11	Peak	30.46	-2.10	28.36	46.00	-17.64

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8 FREQUENCY TOLERANCE

8.1 Applicable Standard

The frequency tolerance of the carrier signal shall be maintained within +/- 0.01% of the operating frequency over a temperature variation of -20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

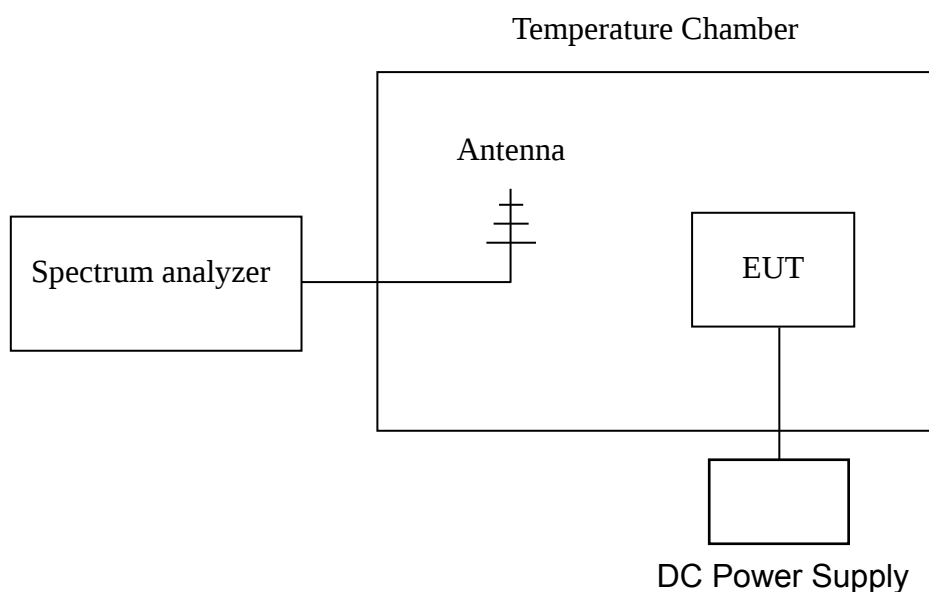
Carrier frequency stability shall be maintained to $\pm 0.01\%$ (± 100 ppm).

For licence-exempt radio apparatus, the frequency stability shall be measured at temperatures of -20°C (-4°F), +20°C (+68°F) and +50°C (+122°F).

8.2 Measurement Procedure

1. The EUT was placed on a turn table which is 0.8m above ground plane.
2. Set EUT as normal operation
3. Set SPA Center Frequency = fundamental frequency, RBW, VBW= 10kHz, Span =100kHz.
4. Set SPA Max hold. Mark peak.

8.3 Test SET-UP (Block Diagram of Configuration)



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8.4 Measurement Equipment Used:

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Loop Antenna	ETS.LINDGREN	6502	148045	2017/09/26	2018/09/25
EXA Spectrum Analyzer	Agilent	N9010A	MY57120290	2018/02/14	2019/02/13
Temperature Chamber	TERCHY	MHG-120LF	911009	05/18/2018	05/17/2019
Coaxial Cables	N/A	WK CE Cable	N/A	2018/01/02	2019/01/01

8.5 Measurement Results

Startup:

A. Temperature Variation

Power Supply	Environment	Frequency	Delta (KHz)	Limit (KHz)
Vdc	Temperature ()	(MHz)		
12	-20	13.560004	0.00530	+/- 1.356
12	-10	13.560006	0.00360	+/- 1.356
12	0	13.560009	0.00060	+/- 1.356
12	10	13.559991	0.01790	+/- 1.356
12	20	13.560009	0.00000	+/- 1.356
12	30	13.559991	0.01790	+/- 1.356
12	40	13.559993	0.01590	+/- 1.356
12	50	13.560007	0.00250	+/- 1.356

B. Supply Voltage Variation

Power Supply	Environment	Frequency	Delta (KHz)	Limit (KHz)
Vdc	Temperature ()	(MHz)		
18	20	13.559993	0.01620	+/- 1.356
12	20	13.560009	0.00000	+/- 1.356
7	20	13.559993	0.01570	+/- 1.356

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2 minutes:

A. Temperature Variation

Power Supply	Environment	Frequency	Delta (KHz)	Limit (KHz)
Vdc	Temperature ()	(MHz)		
12	-20	13.559997	-0.00250	+/- 1.356
12	-10	13.560005	-0.01050	+/- 1.356
12	0	13.5599954	-0.00090	+/- 1.356
12	10	13.5599934	0.00110	+/- 1.356
12	20	13.5599945	0.00000	+/- 1.356
12	30	13.5599969	-0.00240	+/- 1.356
12	40	13.5600059	-0.01140	+/- 1.356
12	50	13.5599906	0.00390	+/- 1.356

B. Supply Voltage Variation

Power Supply	Environment	Frequency	Delta (KHz)	Limit (KHz)
Vdc	Temperature ()	(MHz)		
18	20	13.5599918	0.00270	+/- 1.356
12	20	13.5599945	0.00000	+/- 1.356
7	20	13.5599966	-0.00210	+/- 1.356

5 minutes:

A. Temperature Variation

Power Supply	Environment	Frequency	Delta (KHz)	Limit (KHz)
Vdc	Temperature ()	(MHz)		
12	-20	13.5600054	-0.00660	+/- 1.356
12	-10	13.560004	-0.00520	+/- 1.356
12	0	13.5599998	-0.00100	+/- 1.356
12	10	13.5600048	-0.00600	+/- 1.356
12	20	13.5599988	0.00000	+/- 1.356
12	30	13.560001	-0.01120	+/- 1.356
12	40	13.5599984	0.00040	+/- 1.356
12	50	13.5600044	-0.00560	+/- 1.356

B. Supply Voltage Variation

Power Supply	Environment	Frequency	Delta (KHz)	Limit (KHz)
Vdc	Temperature ()	(MHz)		
18	20	13.5600053	-0.00650	+/- 1.356
12	20	13.5599988	0.00000	+/- 1.356
7	20	13.5599986	0.00020	+/- 1.356

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10 minutes:

A. Temperature Variation

Power Supply	Environment	Frequency	Delta (KHz)	Limit (KHz)
Vdc	Temperature ()	(MHz)		
12	-20	13.5599949	0.00170	+/- 1.356
12	-10	13.5600066	-0.01000	+/- 1.356
12	0	13.5599999	-0.00330	+/- 1.356
12	10	13.5599962	0.00040	+/- 1.356
12	20	13.5599966	0.00000	+/- 1.356
12	30	13.5600059	-0.00930	+/- 1.356
12	40	13.5600075	-0.01090	+/- 1.356
12	50	13.5600045	-0.00790	+/- 1.356

B. Supply Voltage Variation

Power Supply	Environment	Frequency	Delta (KHz)	Limit (KHz)
Vdc	Temperature ()	(MHz)		
18	20	13.5600096	-0.01300	+/- 1.356
12	20	13.5599966	0.00000	+/- 1.356
7	20	13.5600047	-0.00810	+/- 1.356

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9 20 dB & 99% OCCUPIED BANDWIDTH MEASUREMENT

9.1 Applicable Standard:

The 20 dB bandwidth shall be specified in operating frequency band.

9.2 Limit:

None

9.3 Test Set-up

Refer to section 8.3 in this report

9.4 Measurement Procedure

1. Placed the EUT on the testing table.
2. Set the EUT under transmission condition continuously at specific channel frequency.
3. The resolution bandwidth of 1 kHz and the video bandwidth of 3 kHz were used.
4. Measured the spectrum width with power higher than 20dB below carrier.

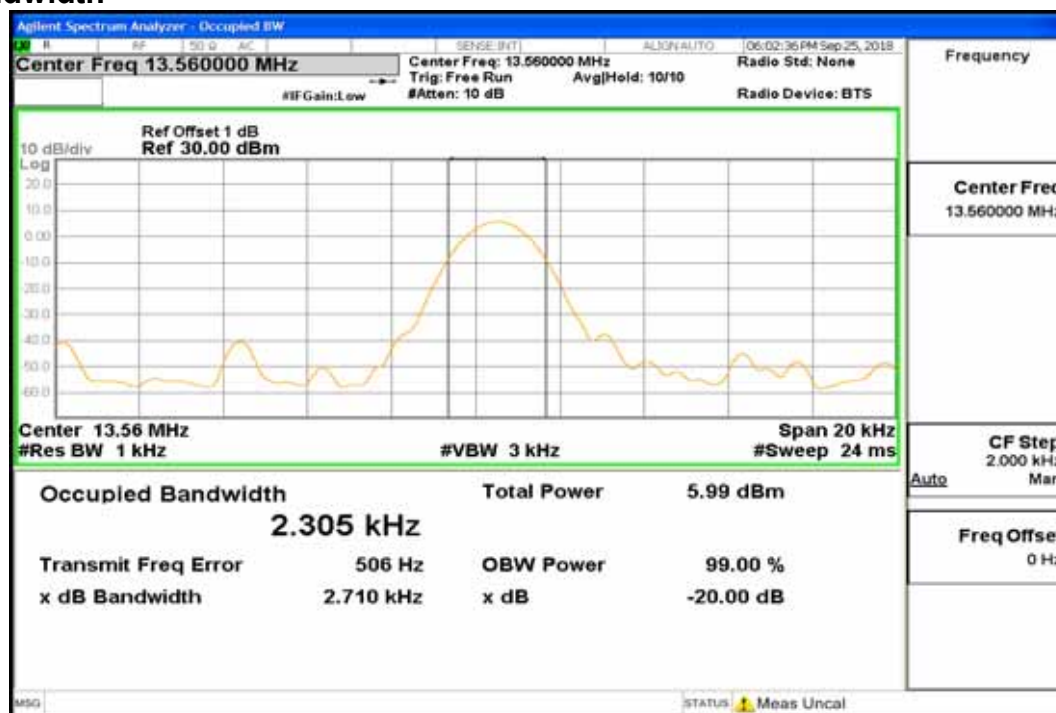
9.5 Measurement Equipment Used:

Refer to section 8.4 in this report

9.6 Measurement Result

	Operation range	Frequency (MHz)	Limit (MHz)
20dB BW (kHz)	Low	13.55934	>13.11
2.71	High	13.56170	<14.01

-20dB Bandwidth



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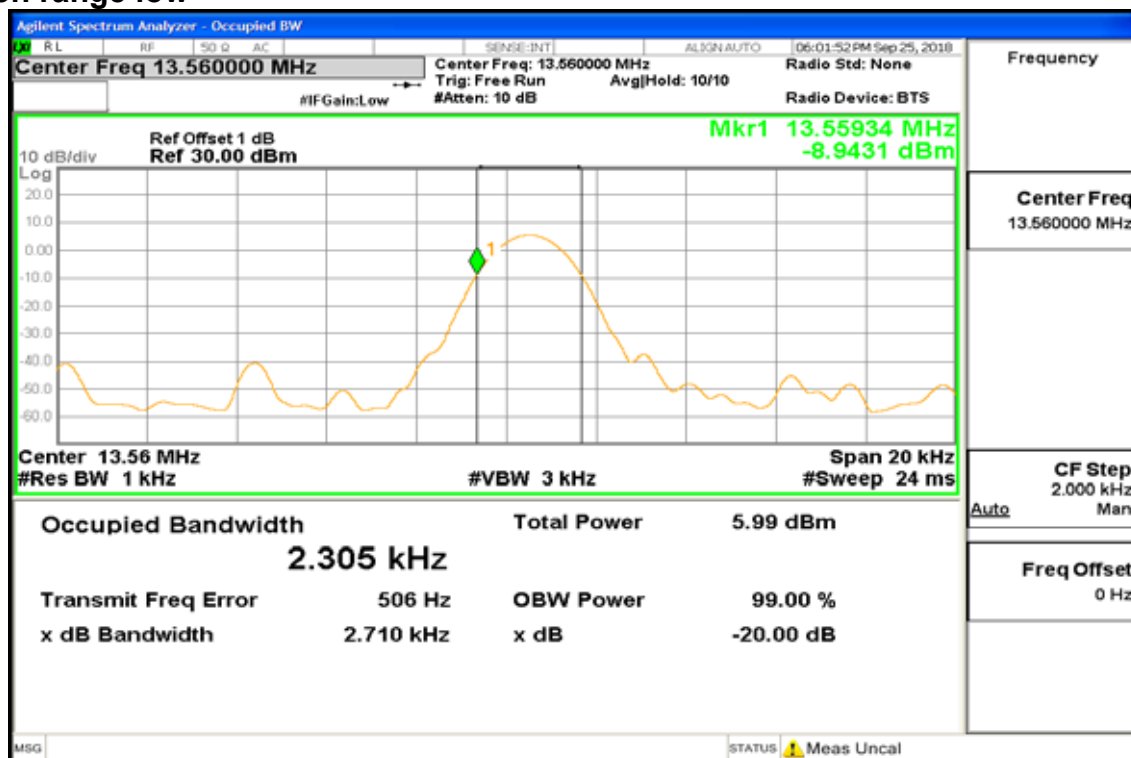
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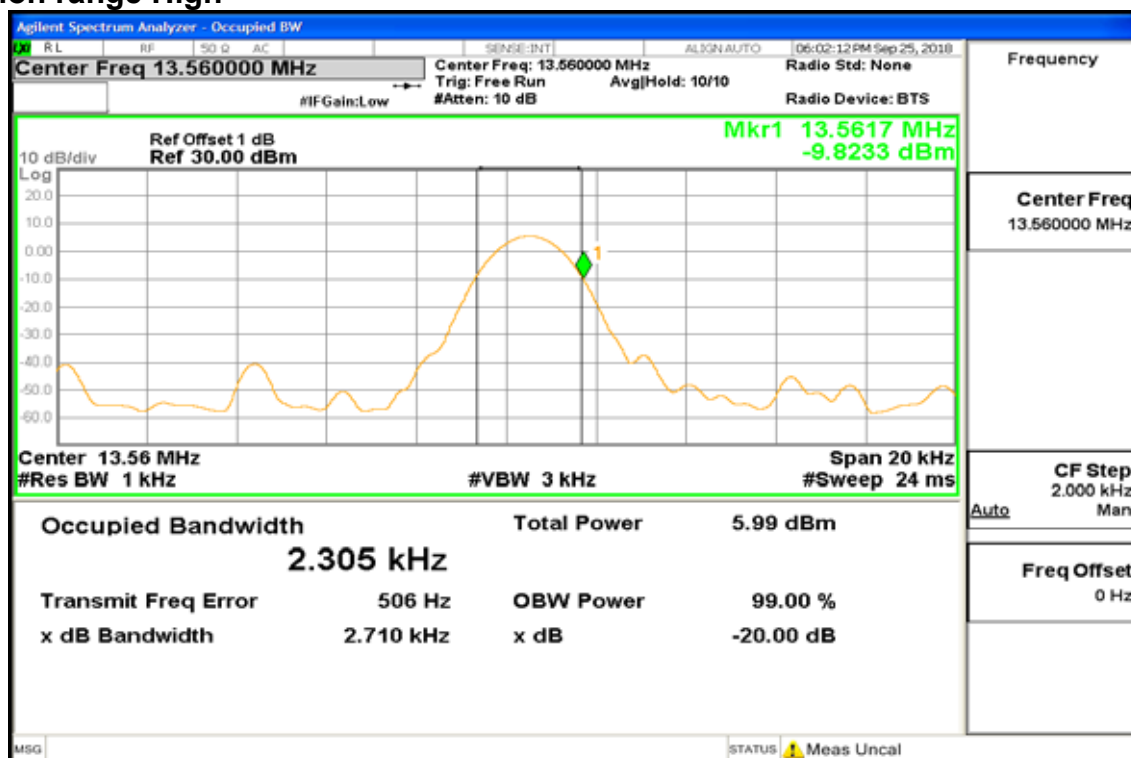
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Operation range low



Operation range High



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10 ANTENNA REQUIREMENT

10.1 Standard Applicable:

For intentional device, according to §15.203, an intentional radiator shall be designed to ensure that no antenna other than furnished by the responsible party shall be used with the device.

10.2 Antenna Connected Construction:

The antenna is designed with unique RF connector and no consideration of replacement. Please see EUT photo for details.

~ End of Report ~

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