

ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

INTENTIONAL RADIATOR CERTIFICATION TO FCC PART 15 SUBPART C AND INDUSTRY CANADA RSS 210 REQUIREMENT CLASS II & IV PC REPORT

OF

Product Name: NFC Module
Brand Name: WNC
Model No.: DFCN-4
Model Difference: N/A
FCC ID: NKR-DFCN4
IC: 4441A-DFCN4
Report No.: ER/2016/B0050
Issue Date: Nov. 22, 2016
FCC Rule §15.225
IC Rule Part: RSS-210 issue 9 Aug.2016 Annex B
Prepared for: Wistron NeWeb Corporation
 20 Park Avenue II, Hsinchu Science Park,
 Hsinchu 308, Taiwan, R.O.C.
 SGS Taiwan Ltd.
Prepared by: Electronics & Communication Laboratory
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VERIFICATION OF COMPLIANCE

Applicant: Wistron NeWeb Corporation
20 Park Avenue II, Hsinchu Science Park, Hsinchu 308, Taiwan,
R.O.C.

Product Name: NFC Module

Brand Name: WNC

Model No.: DFCN-4

Model Difference: N/A

FCC ID: NKR-DFCN4

IC : 4441A-DFCN4

File Number: ER/2016/B0050

Date of test: Nov. 10, 2016 ~ Nov. 17, 2016

Date of EUT Received: Nov. 10, 2016

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

Test By: Nick Lin **Date:** Nov. 22,2016

Nick Lin / Sr. Engineer

Prepared By: Violetta Tang **Date:** Nov. 22,2016

Violetta Tang / Clerk

Approved By: Jim Chang **Date:** Nov. 22,2016

Jim Chang / Asst. Manager

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Revision History

Report Number	Revision	Description	Issue Date
ER/2016/B0050	Rev.00	Initial creation of document	Nov. 22,2016

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1 GENERAL INFORMATION

1.1 Product Description

General:

Product Name of Host:	Tablet	
Brand Name:	HP	
Model No. of Host:	HSN-I06C	
Model Difference:	N/A	
Hardware Version:	N/A	
Software Version:	N/A	
Model No. of NFC Module:	DFCN-4	
Module FCC ID:	NKR-DFCN4	
Module IC:	4441A-DFCN4	
Scope:	The test report covers the radiated emissions requirements of the standards referenced in the report to allow system level approval of the module in this specific host.	
Class II & Class IV Permissive change:	NFC Module (DFCN-4) installed in a Tablet and added two sources of antenna.	
Retail Case:	Model No.: TPA-I601J, Supplier: HP	
Keyboard:	Model No.: HSN-D06K, Supplier: HP	
Power Supply:	7.7Vdc from Rechargeable Li-Polymer Battery or 5 / 9 / 10 / 12 / 15 / 20 Vdc from AC/DC Adapter	
	Battery:	Model No.: HSTNN-DB7Q; Supplier: DYNAPACK ELECTRONIC TECHNOLOGY (SUZHOU) CO., LTD.
	Adapter:	1. Model No.: TPN-CA06, Supplier: CHICONY POWER TECHNOLOGY (CHONGQING) CO., LTD. 2. Model No.: TPN-AA03, Supplier: Acbel Electronic (Wuhan) Co., Ltd. 3. Model No.: TPN-DA07, Supplier: DELTA ELECTRONICS (JIANGSU) LTD. 4. Model No.: TPN-LA06, Supplier: LITE-ON TECHNOLOGY (CHANGZHOU)CO., LTD.

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NFC:

Operating Frequency:	13.56MHz
Transmit Power:	< 123.90dBuV/m at 3m.
Number of Channels:	1
Antenna Type:	Loop Antenna 1. ACON 2. YAGEO
Modulation Type:	ASK

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1.2 Test Methodology of Applied Standards

FCC Part 15, Subpart C §15.225

IC RSS 210 issue 9 Aug.2016 Annex B

RSS-Gen. issue 4 Nov. 2014

ANSI C63.10:2013

Note:

1. 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 (TAF code 0513)

FCC Registration Numbers are: 509634

Canada Registration Number: 4620A-5 .

1.4 Special Accessories

There is no special accessory used while test was conducted.

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

An engineering test mode (software/firmware) that applicant provided was utilized to manipulate the EUT into transmit, selection of the test channel, and modulation scheme.

2.3 Test Procedure

2.3.1 Conducted Emissions

The EUT is a placed on as turn table which is 0.8 m above ground plan. 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 §15.207. 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 which is 0.8 m above ground plan. 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 hand-held 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.

2.4 Measurement Results Explanation Example

For all conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuation factor between EUT conducted port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly EUT RF output level.

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2.5 Configuration of Tested System

Fig. 2-1 Radiated Emission & AC Power Line Conducted Emission

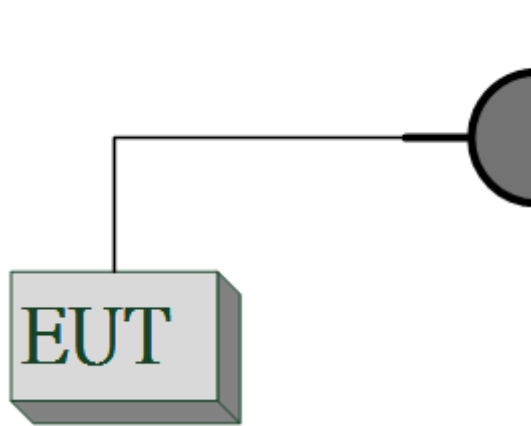


Table 2-1 Equipment Used in Tested System

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 § 6.6	99% & 20 dB OCCUPIED BANDWIDTH	Compliant
§15.203 RSS-Gen § 6.7, § 8.3	Antenna Requirement	Compliant

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4 DESCRIPTION OF TEST MODES

4.1 The Worst Test Modes and Channel Details

1. The EUT stay in continuous transmitting 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. Investigation has been done on all the possible configurations for searching the worst case.

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 mode) and lie down position (E1, E2 mode) for NFC Transmitter for channel the worst case H position was reported.

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5 MEASUREMENT UNCERTAINTY

Test Items	Uncertainty
AC Power Line Conducted Emission	+/- 2.586 dB
Frequency Stability	+/- 51.33 Hz
20 dB OCCUPIED BANDWIDTH	+/- 51.33 Hz
Temperature	+/- 0.65 °C
Humidity	+/- 4.6 %
DC / AC Power Source	DC= +/- 0.13%, AC= +/- 0.2%

Radiated Spurious Emission:

Measurement uncertainty (Polarization : Vertical)	9kHz - 30MHz: +/- 2.87dB
	30MHz - 180MHz: +/- 3.37dB
	180MHz -417MHz: +/- 3.19dB
	0.417GHz-1GHz: +/- 3.19dB

Measurement uncertainty (Polarization : Horizontal)	9kHz - 30MHz: +/- 2.87dB
	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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6 CONDUCTED EMISSION TEST

6.1 Standard Applicable:

Frequency range within 150kHz to 30MHz shall not exceed the Limit table as below.

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

- The lower limit shall apply at the transition frequencies
- The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.

6.2 Measurement Equipment Used:

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
EMI Test Receiver	R&S	ESC17	100760	05/10/2016	05/09/2017
LISN	SCHWARZBECK	NSLK 8127	8127-649	05/16/2016	05/15/2017
LISN	MESS TEC	FCC-LISN-50/250 -25-2-01	4034	05/16/2016	05/15/2017
Coaxial Cables	N/A	WK CE Cable	N/A	11/26/2015	11/25/2016

6.3 EUT Setup:

- The conducted emission tests were performed in the test site, using the setup in accordance with the ANSI C63.10:2013.
- The AC/DC Power adaptor of EUT was plug-in LISN. The EUT was placed flushed with the rear of the table.
- The LISN was connected with 120Vac/60Hz power source.

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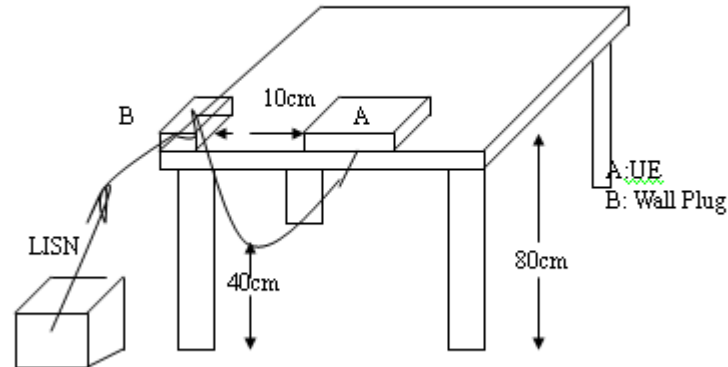
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6.4 Test SET-UP (Block Diagram of Configuration)



6.5 Measurement Procedure:

1. The EUT was placed on a table which is 0.8m above ground plan.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. Repeat above procedures until all frequency measured were complete.

6.6 Measurement Result:

Note: Refer to next page for measurement data and plots.

Note2: The * reveals the worst-case results that closet to the limit

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AC POWER LINE CONDUCTED EMISSION TEST DATA

Operation Mode:	Operation mode	Test By:	Nick
Temperature:	20		

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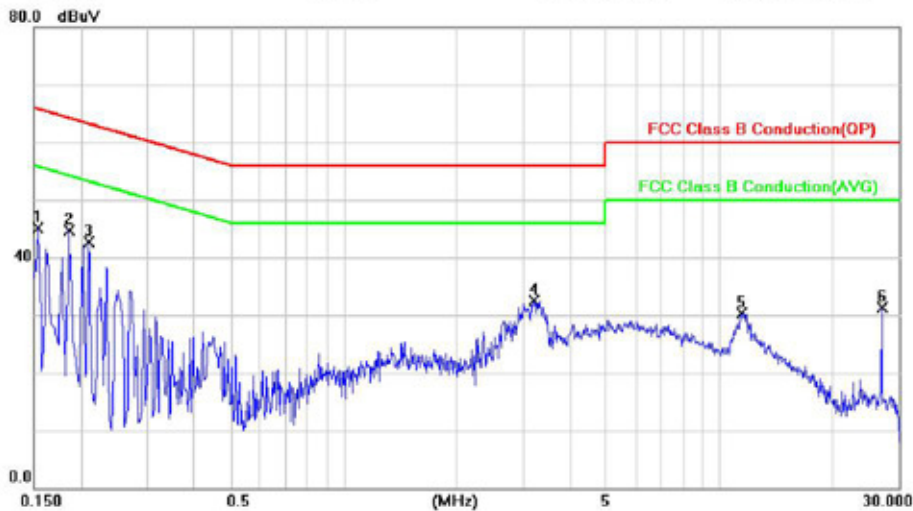
Site Conduction Room
Limit: FCC Class B Conduction(QP)
Mode: Operation
Note: Adapter:TPN CA06

Phase: N
Power: AC 120V/60Hz

Temperature: 20 °C
Humidity: 58 %

Conducted Emission

File :90052 Data :#15 Date: 2018/11/21 Time: 下午 10:42:42



No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Detector	Comment
		MHz	dBuV	dB	dBuV	dBuV	dB		
1		0.1540	44.99	0.07	45.06	65.78	-20.72	peak	
2	*	0.1860	44.67	0.08	44.75	64.21	-19.46	peak	
3		0.2100	42.71	0.08	42.79	63.21	-20.42	peak	
4		3.2180	32.32	0.20	32.52	56.00	-23.48	peak	
5		11.4620	30.01	0.38	30.39	60.00	-29.61	peak	
6		27.0940	30.87	0.46	31.33	60.00	-28.67	peak	

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AC POWER LINE CONDUCTED EMISSION TEST DATA

Operation Mode:	Operation mode	Test By:	Nick
Temperature:	20		

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AC POWER LINE CONDUCTED EMISSION TEST DATA

Operation Mode:	Operation mode	Test By:	Nick
Temperature:	20		

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AC POWER LINE CONDUCTED EMISSION TEST DATA

Operation Mode:	Operation mode	Test By:	Nick
Temperature:	20		

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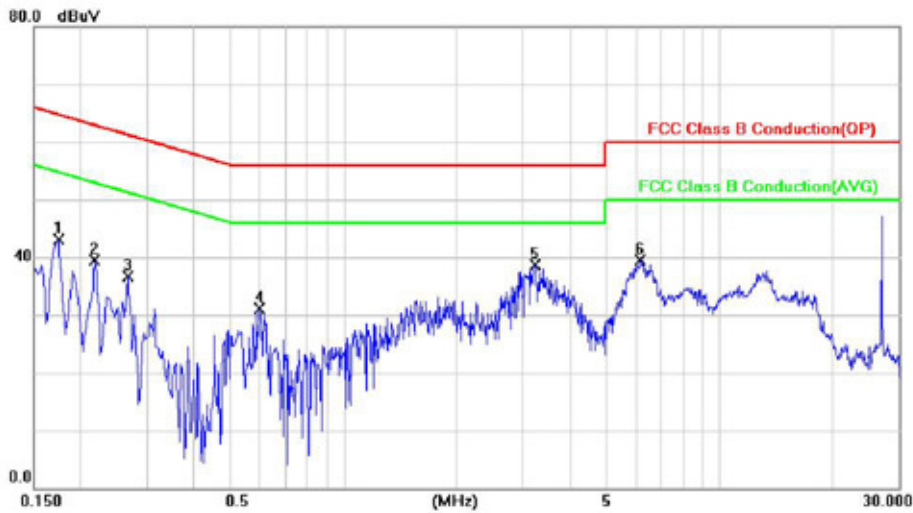
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Site Conduction Room	Phase: N	Temperature: 20 °C
Limit: FCC Class B Conduction(QP)	Power: AC 120V/60Hz	Humidity: 58 %
Mode: Operation		
Note: Adapter:TPN LA06		

Conducted Emission

File :90052 Data :#9 Date: 2016/11/21 Time: 下午 10:36:11



No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Detector	Comment
		MHz	dBuV	dB	dBuV	dBuV	dB		
1		0.1740	43.06	0.07	43.13	64.77	-21.64	peak	
2		0.2180	39.38	0.08	39.46	62.89	-23.43	peak	
3		0.2660	36.68	0.09	36.77	61.24	-24.47	peak	
4		0.5980	31.04	0.11	31.15	56.00	-24.85	peak	
5 *		3.2260	38.45	0.20	38.65	56.00	-17.35	peak	
6		6.1660	39.20	0.31	39.51	60.00	-20.49	peak	

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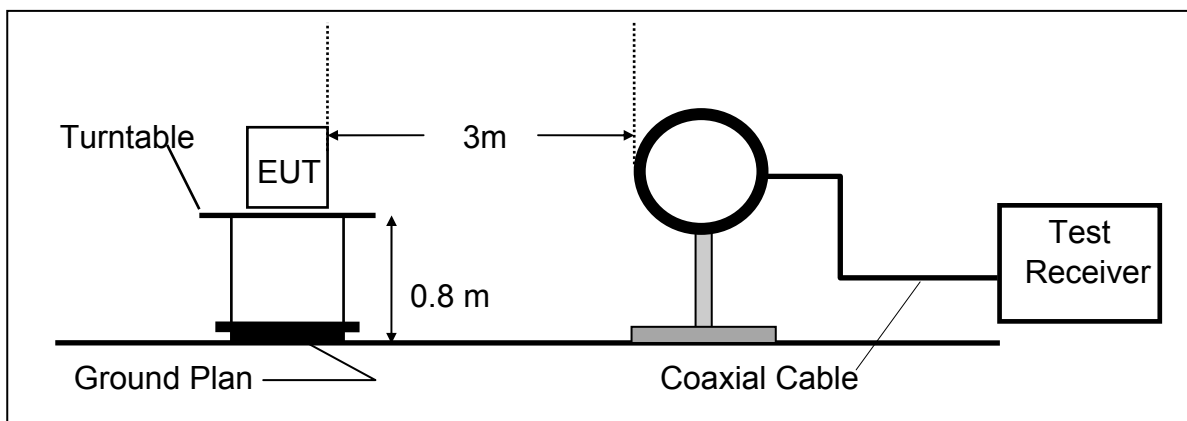
7 RADIATED TEST ITEMS

7.1 Measurement Procedure

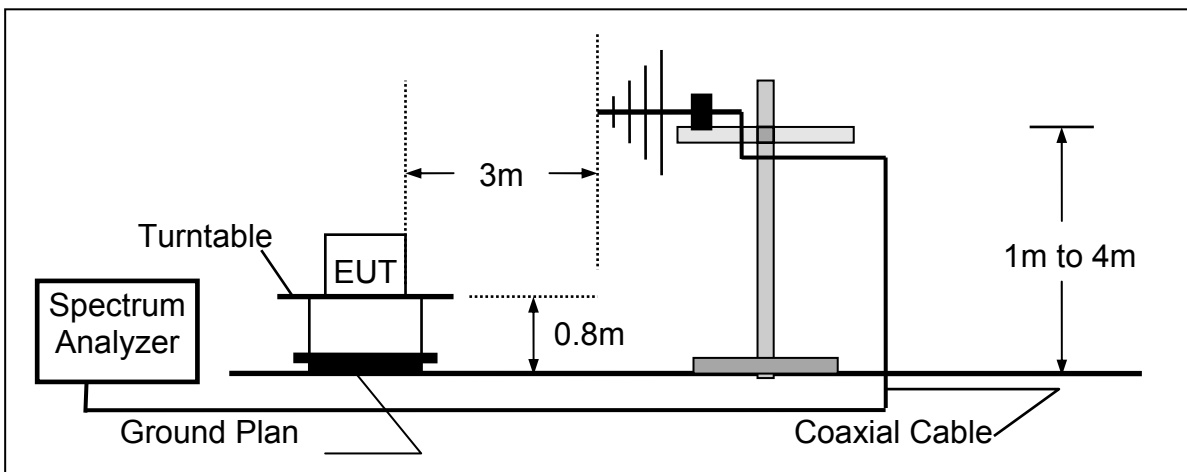
1. Configure the EUT according to ANSI C63.4.
2. The EUT was placed on a turn table which is 0.8m above ground plan.
3. The turn table shall rotate 360 degrees to determine the position of maximum emission level.
4. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out 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

(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 SAC-III					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
EMI Test Receiver	R&S	ESC17	100760	05/10/2016	05/09/2017
Spectrum Analyzer	Agilent	E4446A	MY51100003	01/29/2016	01/28/2017
Loop Antenna	ETS-Lindgren	6502	143303	12/23/2015	12/22/2016
Bilog Antenna	SCHWAZBECK	VULB9168	378	12/14/2015	12/13/2016
Horn Antenna	Schwarzbeck	BBHA9120D	1441	08/01/2016	07/31/2017
Pre-Amplifier	Agilent	8447D	2944A07676	01/02/2016	01/01/2017
Pre-Amplifier	EMC Instruments Corp.	EMC0126530	980038	01/02/2016	01/01/2017
Turn Table	HD	DT420	N/A	N.C.R	N.C.R
Antenna Tower	ChamPro	AM-BS-4500-B	060776-ABS	N.C.R	N.C.R
Controller	ChamPro	EM1000	60776	N.C.R	N.C.R
Low Loss Cable	Huber Suhner	966_RX	9	01/02/2016	01/01/2017
3m Site NSA	SGS	966 chamber	N/A	07/01/2016	06/30/2017
Low Loss Cable	Huber Suhner	966 TX	1	01/02/2016	01/01/2017
Horn Antenna	Schwarzbeck	BBHA9170	184	12/12/2015	12/11/2016
Pre-Amplifier	EMC Instruments Corp.	EMC184045	980135	01/02/2016	01/01/2017

Note: N.C.R refers to Not Calibrated Required.

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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	

The limit of the emission level is expressed in dBuV/m, which converts $20 \cdot \log(\mu\text{V/m})$

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

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

Note :

“F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

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7.5 Field Strength of Fundamental Emissions and Mask Measurement

7.5.1 Standard Applicable

Limit:

Rules and specifications	CFR 47 Part 15 section 15.225(a)-(d)		
	Frequency of Emission (MHz)	Field Strength ($\mu\text{V/m}$) at 30m	Field Strength (dB $\mu\text{V/m}$) at 30m
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	123.9
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.

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

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

1. Emission level in dBuV/m = $20 \log (\mu\text{V/m})$
2. Distance extrapolation factor = $40 \log (\text{required distance} / \text{test distance})$ (dB)
3. The lower limit shall apply at the transition frequencies.
4. 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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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) $20 \cdot \log(106 \text{ uV/m}) + 40 \text{ dB} = 80.50 \text{ dBuV/m}$

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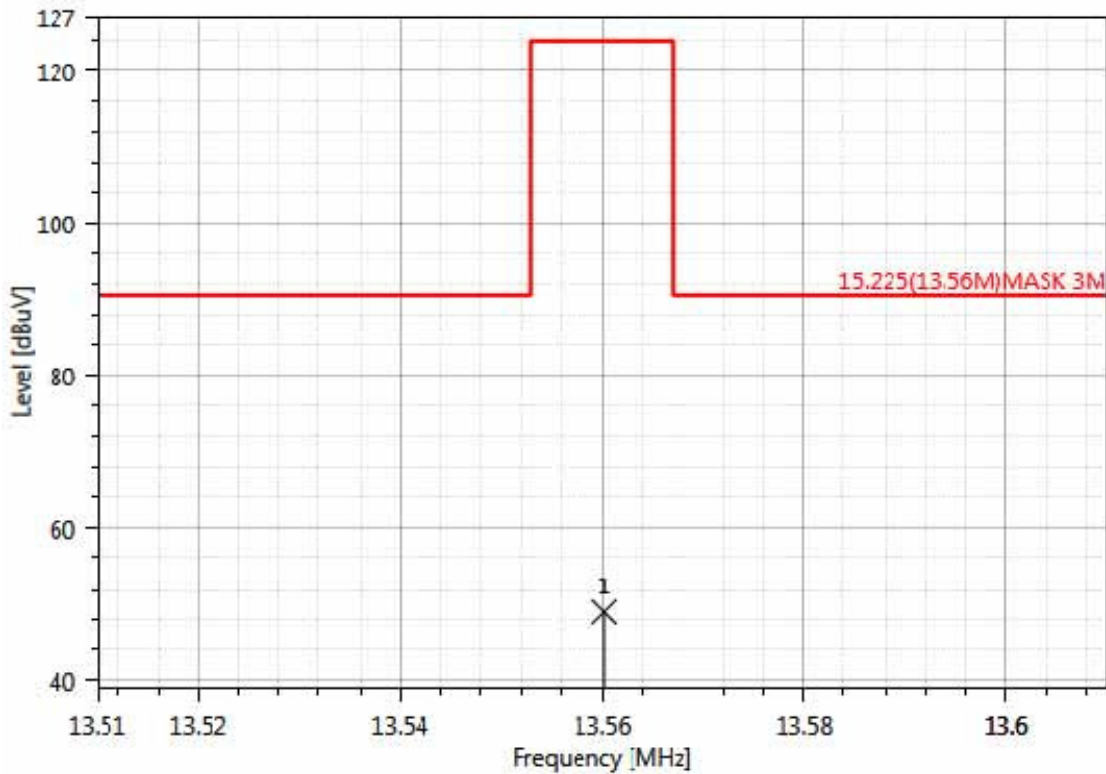
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7.5.2 Field Strength of Fundamental Emission Measurement Result ACON

Operation Mode :	RFID	Test Date :	11/14/2016
Fundamental Frequency :	13.56 MHz	Temp. / Humi. :	23.8 deg_C/59 RH
Operation Band :	Main	Test Engineer :	Kane
EUT Pol. :	H Plane	Measurement Antenna Pol. :	VERTICAL



Freq. MHz	Note F/H/E/S	Decetor Mode QP/AV/PK	Actual Reading Level dB μ V/m	Spectrum FS dB μ V/m	Factor dB	Limit @3m dBuV/m	Margin dB
13.56	F	Peak	48.92	37.48	11.44	123.90	-74.98

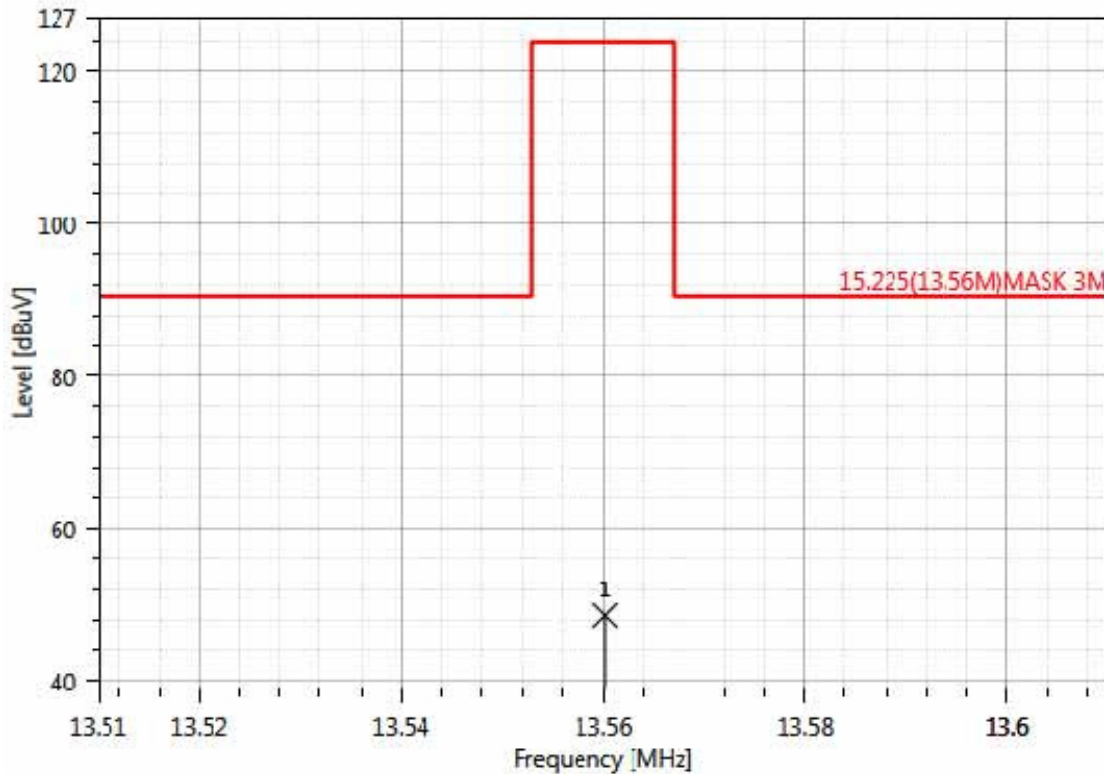
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Operation Mode :	RFID	Test Date :	11/14/2016
Fundamental Frequency :	13.56 MHz	Temp. / Humi. :	23.8 deg_C/59 RH
Operation Band :	Main	Test Engineer :	Kane
EUT Pol. :	H Plane	Measurement Antenna Pol. :	HORIZONTAL



Freq.	Note	Decetor Mode	Actual Reading Level	Spectrum FS	Factor	Limit @3m	Margin
MHz	F/H/E/S	QP/AV/PK	dBμV/m	dBμV/m	dB	dBuV/m	dB
13.56	F	Peak	48.60	37.16	11.44	123.90	-75.30

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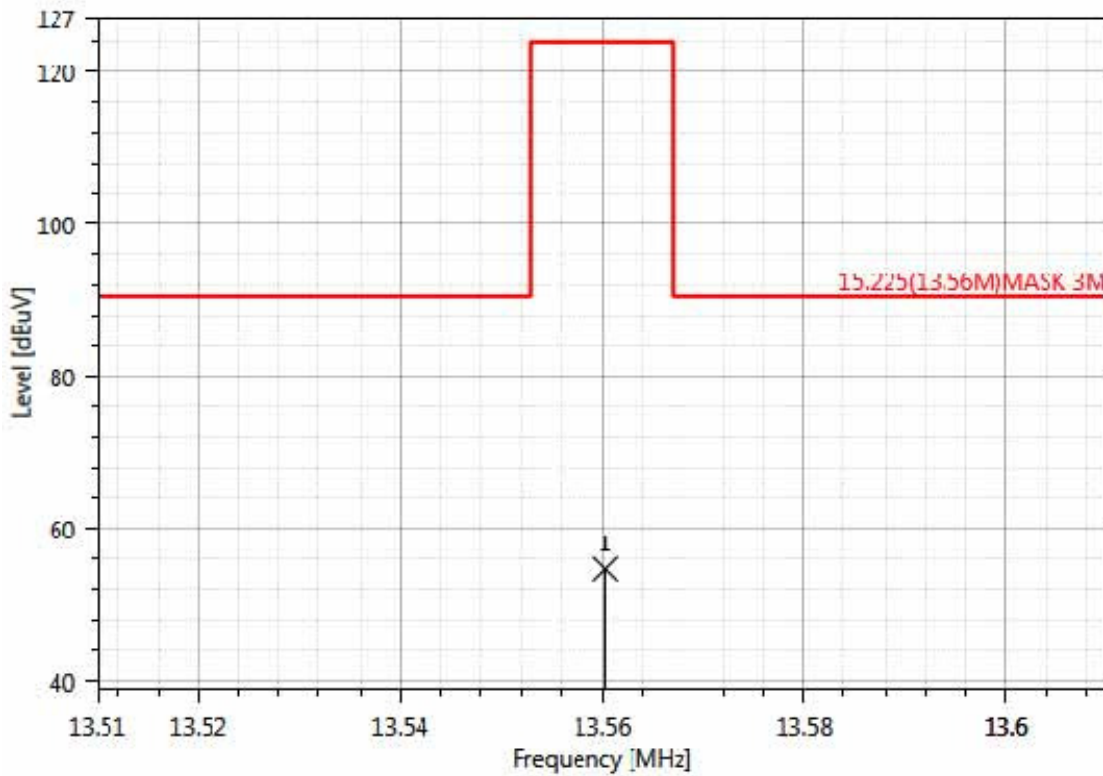
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Operation Mode :	RFID	Test Date :	11/14/2016
Fundamental Frequency :	13.56 MHz	Temp. / Humi. :	23.8 deg_C/59 RH
Operation Band :	Main	Test Engineer :	Kane
EUT Pol. :	H Plane	Measurement Antenna Pol. :	VERTICAL



Freq. MHz	Note F/H/E/S	Decetor Mode QP/AV/PK	Actual Reading Level dB μ V/m	Spectrum FS dB μ V/m	Factor dB	Limit @3m dBuV/m	Margin dB
13.56	F	Peak	54.74	43.30	11.44	123.90	-69.16

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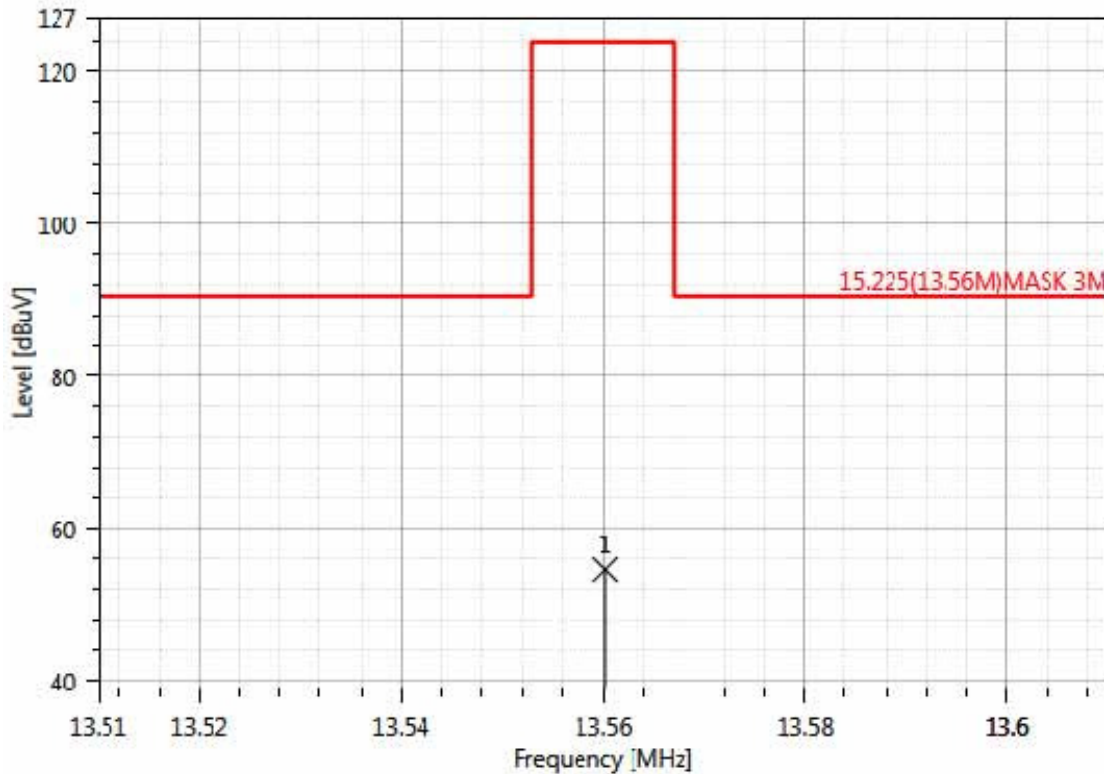
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Operation Mode :	RFID	Test Date :	11/14/2016
Fundamental Frequency :	13.56 MHz	Temp. / Humi. :	23.8 deg_C/59 RH
Operation Band :	Main	Test Engineer :	Kane
EUT Pol. :	H Plane	Measurement Antenna Pol. :	HORIZONTAL



Freq.	Note	Decetor Mode	Actual Reading Level	Spectrum FS	Factor	Limit @3m	Margin
MHz	F/H/E/S	QP/AV/PK	dBμV/m	dBμV/m	dB	dBuV/m	dB
13.56	F	Peak	54.64	43.20	11.44	123.90	-69.26

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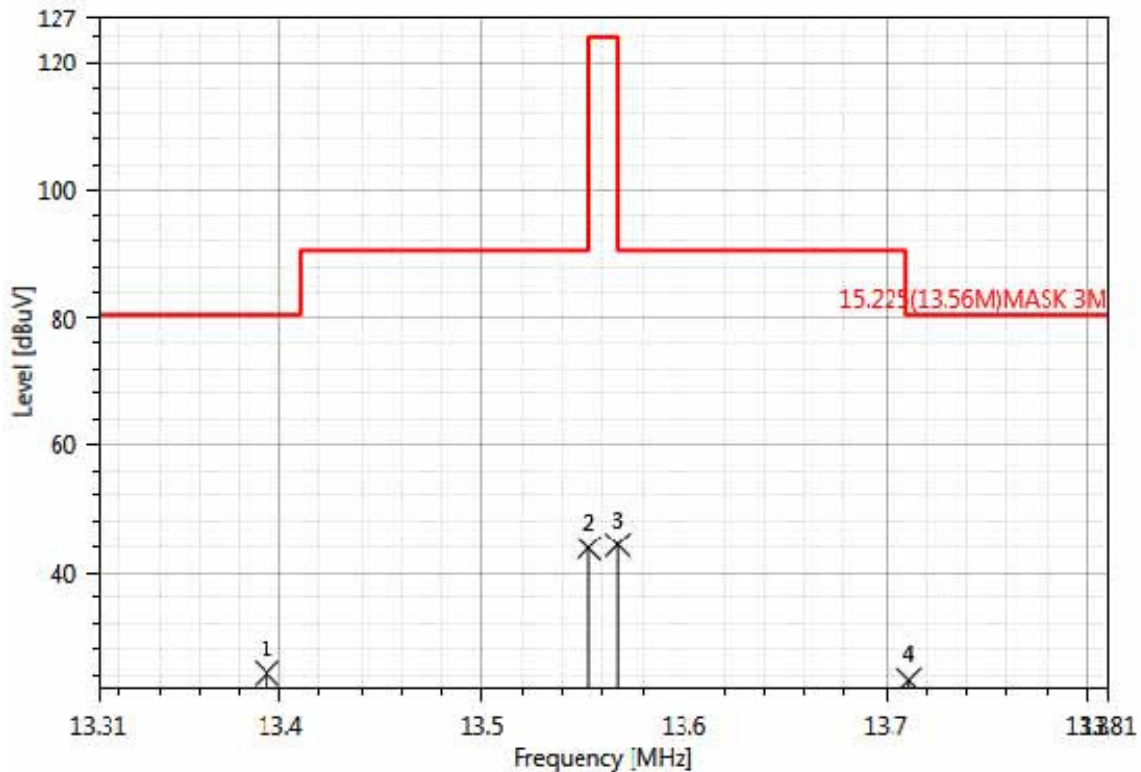
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7.5.3 Mask Measurement Result ACON

Operation Mode :	RFID	Test Date :	11/14/2016
Fundamental Frequency :	13.56 MHz	Temp. / Humi. :	23.8 deg_C/59 RH
Operation Band :	Mask	Test Engineer :	Kane
EUT Pol. :	H Plane	Measurement Antenna Pol. :	VERTICAL



Freq. MHz	Note F/H/E/S	Decetor Mode QP/AV/PK	Actual Reading Level dBµV/m	Spectrum FS dBµV/m	Factor dB	Limit @3m dBuV/m	Margin dB
13.39	S	Peak	24.29	12.86	11.43	80.50	-56.21
13.55	F	Peak	43.84	32.41	11.44	90.47	-46.63
13.57	F	Peak	44.37	32.93	11.44	90.47	-46.10
13.71	S	Peak	23.22	11.78	11.44	80.50	-57.28

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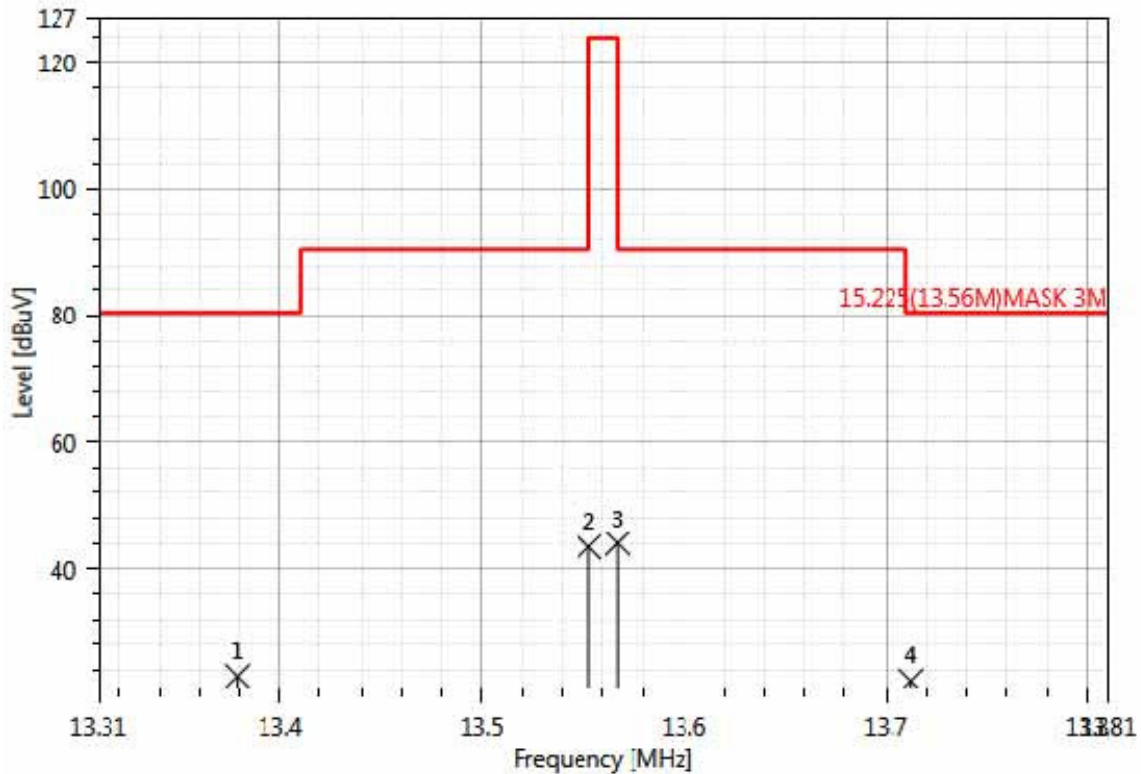
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Operation Mode :	RFID	Test Date :	11/14/2016
Fundamental Frequency :	13.56 MHz	Temp. / Humi. :	23.8 deg_C/59 RH
Operation Band :	Mask	Test Engineer :	Kane
EUT Pol. :	H Plane	Measurement Antenna Pol. :	HORIZONTAL



Freq. MHz	Note F/H/E/S	Decetor Mode QP/AV/PK	Actual Reading Level dB μ V/m	Spectrum FS dB μ V/m	Factor dB	Limit @3m dBuV/m	Margin dB
13.38	S	Peak	23.03	11.60	11.43	80.50	-57.47
13.55	F	Peak	43.42	31.99	11.44	90.47	-47.05
13.57	F	Peak	44.01	32.57	11.44	90.47	-46.46
13.71	S	Peak	22.30	10.86	11.44	80.50	-58.20

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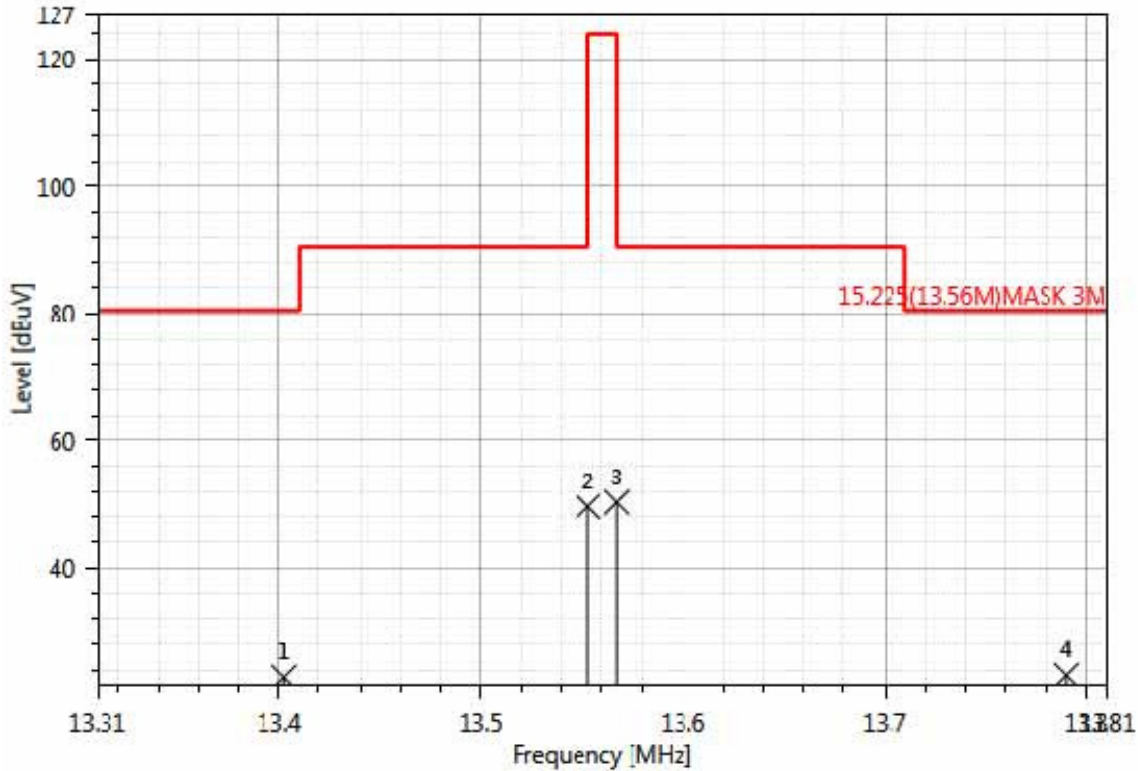
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Operation Mode :	RFID	Test Date :	11/14/2016
Fundamental Frequency :	13.56 MHz	Temp. / Humi. :	23.8 deg_C/59 RH
Operation Band :	Mask	Test Engineer :	Kane
EUT Pol. :	H Plane	Measurement Antenna Pol. :	VERTICAL



Freq. MHz	Note F/H/E/S	Decetor Mode QP/AV/PK	Actual Reading Level dBµV/m	Spectrum FS dBµV/m	Factor dB	Limit @3m dBuV/m	Margin dB
13.40	S	Peak	22.90	11.47	11.43	80.50	-57.60
13.55	F	Peak	49.69	38.25	11.44	90.47	-40.78
13.57	F	Peak	50.33	38.90	11.44	90.47	-40.14
13.79	S	Peak	23.22	11.78	11.44	80.50	-57.28

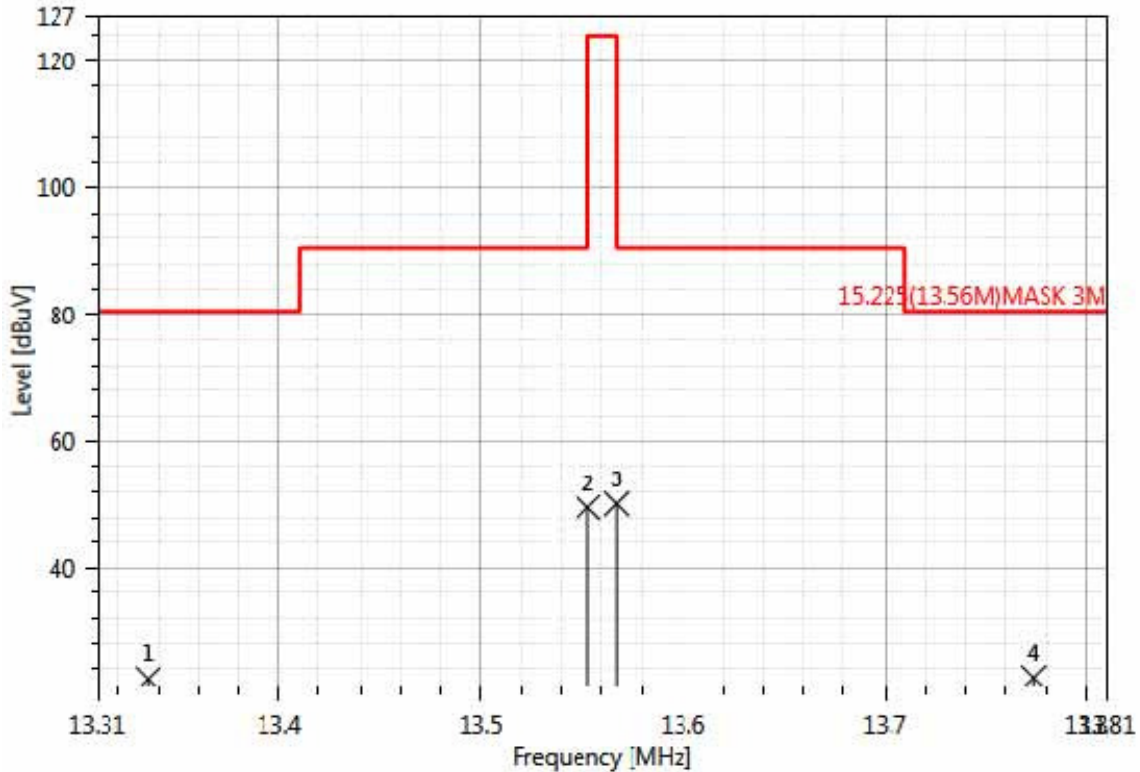
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Operation Mode :	RFID	Test Date :	11/14/2016
Fundamental Frequency :	13.56 MHz	Temp. / Humi. :	23.8 deg_C/59 RH
Operation Band :	Mask	Test Engineer :	Kane
EUT Pol. :	H Plane	Measurement Antenna Pol. :	HORIZONTAL



Freq. MHz	Note F/H/E/S	Decetor Mode QP/AV/PK	Actual Reading Level dB μ V/m	Spectrum FS dB μ V/m	Factor dB	Limit @3m dBuV/m	Margin dB
13.34	S	Peak	22.51	11.08	11.43	80.50	-57.99
13.55	F	Peak	49.56	38.12	11.44	90.47	-40.91
13.57	F	Peak	50.12	38.68	11.44	90.47	-40.35
13.77	S	Peak	22.71	11.27	11.44	80.50	-57.79

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7.6 Radiated Emission Measurement

7.6.1 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 ($\mu\text{V/m}$)	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 $\text{dB}\mu\text{V/m} = 20 \log(\mu\text{V/m})$
2. Distance extrapolation factor = $40 \log(\text{required distance}/\text{test distance})$ (dB)
3. The lower limit shall apply at the transition frequencies.
4. The measurement was undertaken in closer distance at 3m, where extrapolation factor is offset to convert the limit of the measurement.

According to § RSS-210 Annex B B.6

(d) 30 microvolts/m (29.4 $\text{dB}\mu\text{V/m}$) at 30 m, outside the band 13.110-14.010 MHz.

Limit is converted by adding the distance extrapolation factor as the measurement distance was to place at 3m.

a) $20 \cdot \log(30\mu\text{V/m}) + 40\text{dB} = 69.54 \text{ dB}\mu\text{V/m}$

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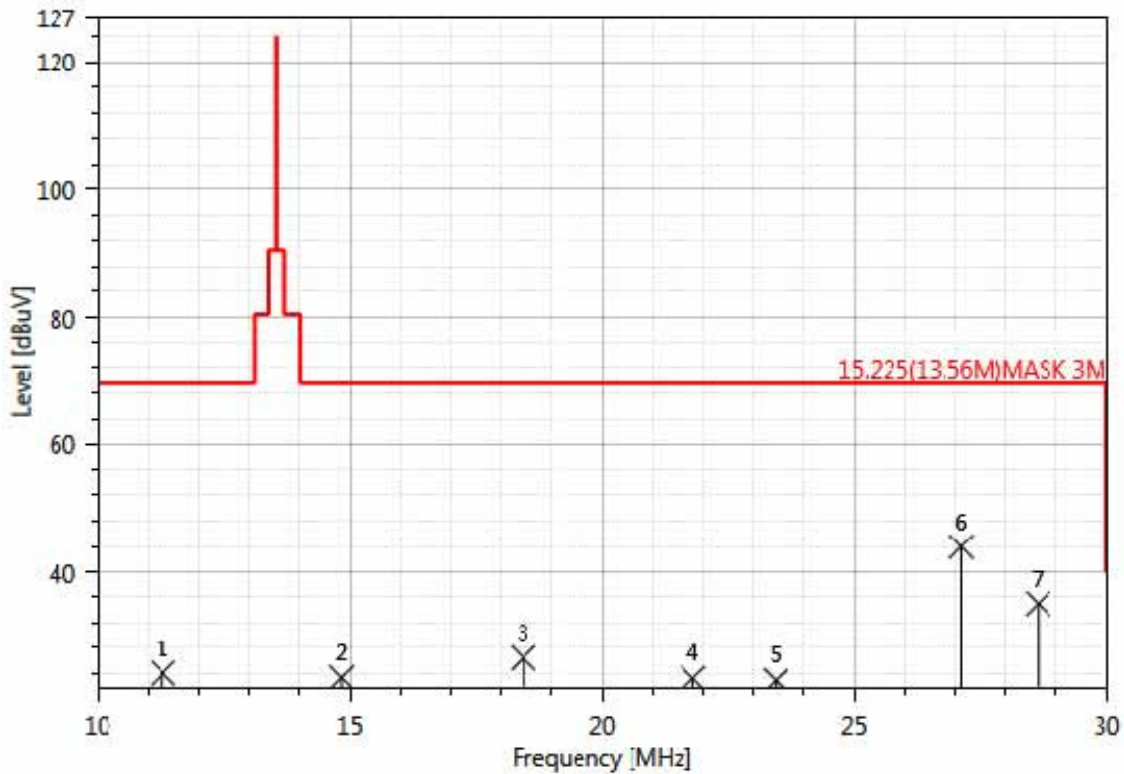
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Radiated Emission Measurement Result ACON

Operation Mode :	RFID	Test Date :	11/14/2016
Fundamental Frequency :	13.56 MHz	Temp. / Humi. :	23.8 deg_C/59 RH
Operation Band :	Tx	Test Engineer :	Kane
EUT Pol. :	H Plane	Measurement Antenna Pol. :	VERTICAL



Freq. MHz	Note F/H/E/S	Decetor Mode QP/AV/PK	Actual Reading Level dB μ V/m	Spectrum FS dB μ V/m	Factor dB	Limit @3m dBuV/m	Margin dB
11.30	S	Peak	24.17	12.79	11.38	69.54	-45.37
14.84	S	Peak	23.48	12.02	11.46	69.54	-46.06
18.44	S	Peak	26.53	14.99	11.55	69.54	-43.01
21.80	S	Peak	23.38	12.34	11.04	69.54	-46.16
23.44	S	Peak	23.06	12.47	10.59	69.54	-46.48
27.12	H	Peak	43.97	34.27	9.70	69.54	-25.57
28.64	S	Peak	34.93	25.57	9.36	69.54	-34.61

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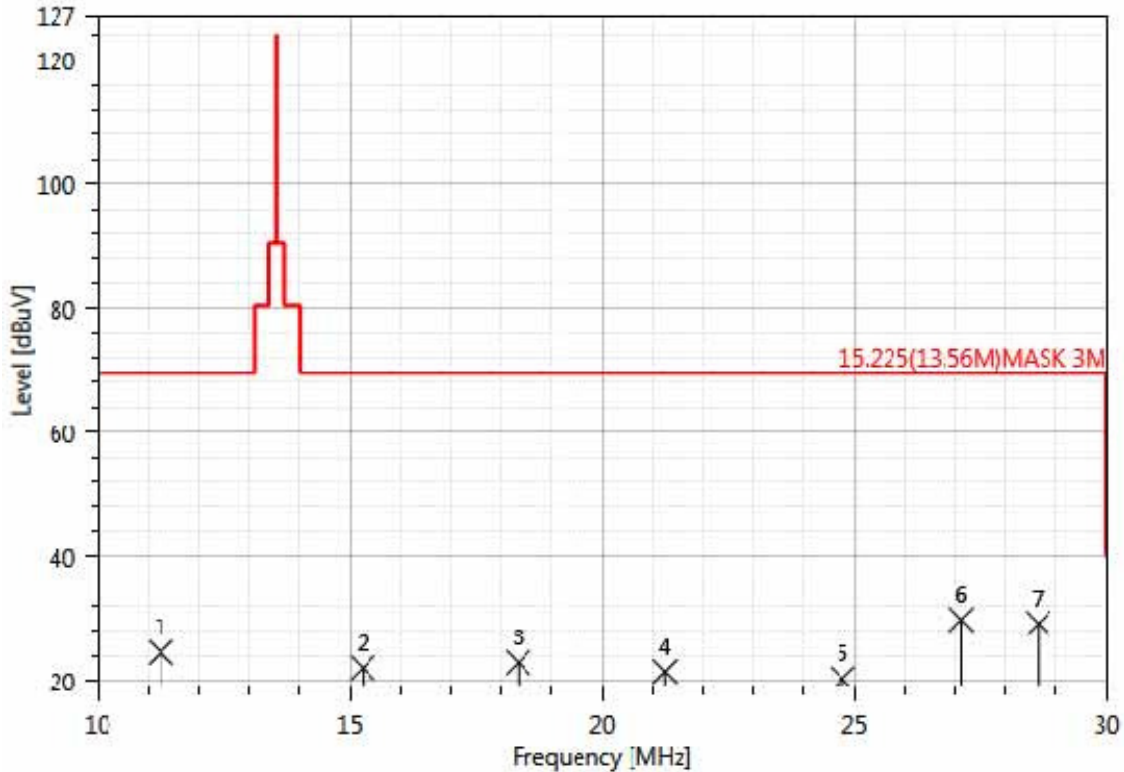
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Operation Mode : RFID Test Date : 11/14/2016
 Fundamental Frequency : 13.56 MHz Temp. / Humi. : 23.8 deg_C/59 RH
 Operation Band : Tx Test Engineer : Kane
 EUT Pol. : H Plane Measurement Antenna Pol. : HORIZONTAL



Freq. MHz	Note F/H/E/S	Decetor Mode QP/AV/PK	Actual Reading Level dB μ V/m	Spectrum FS dB μ V/m	Factor dB	Limit @3m dBuV/m	Margin dB
11.26	S	Peak	24.56	13.19	11.37	69.54	-44.98
15.26	S	Peak	22.10	10.63	11.47	69.54	-47.44
18.34	S	Peak	22.96	11.41	11.54	69.54	-46.58
21.24	S	Peak	21.51	10.31	11.20	69.54	-48.03
24.76	S	Peak	20.35	10.09	10.25	69.54	-49.19
27.12	H	Peak	29.83	20.13	9.70	69.54	-39.71
28.64	S	Peak	29.23	19.87	9.36	69.54	-40.31

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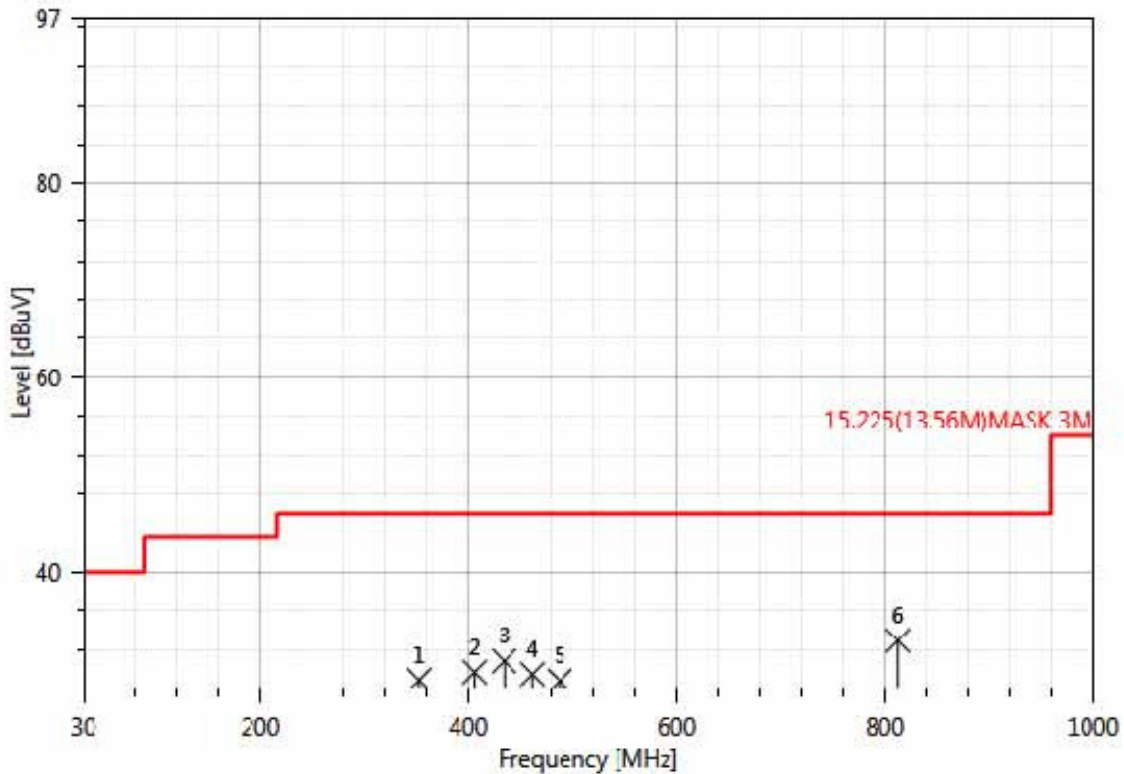
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 Operation Band : Tx Test Engineer : Kane
 EUT Pol. : H Plane Measurement Antenna Pol. : VERTICAL



Freq. MHz	Note F/H/E/S	Decetor Mode QP/AV/PK	Actual Reading Level dBµV/m	Spectrum FS dBµV/m	Factor dB	Limit @3m dBuV/m	Margin dB
353.01	H	Peak	28.86	33.76	-4.90	46.00	-17.14
406.36	H	Peak	29.67	33.26	-3.59	46.00	-16.33
434.49	H	Peak	30.81	34.37	-3.56	46.00	-15.19
461.65	H	Peak	29.47	32.07	-2.60	46.00	-16.53
487.84	H	Peak	28.78	31.12	-2.34	46.00	-17.22
812.79	H	Peak	32.91	29.55	3.35	46.00	-13.09

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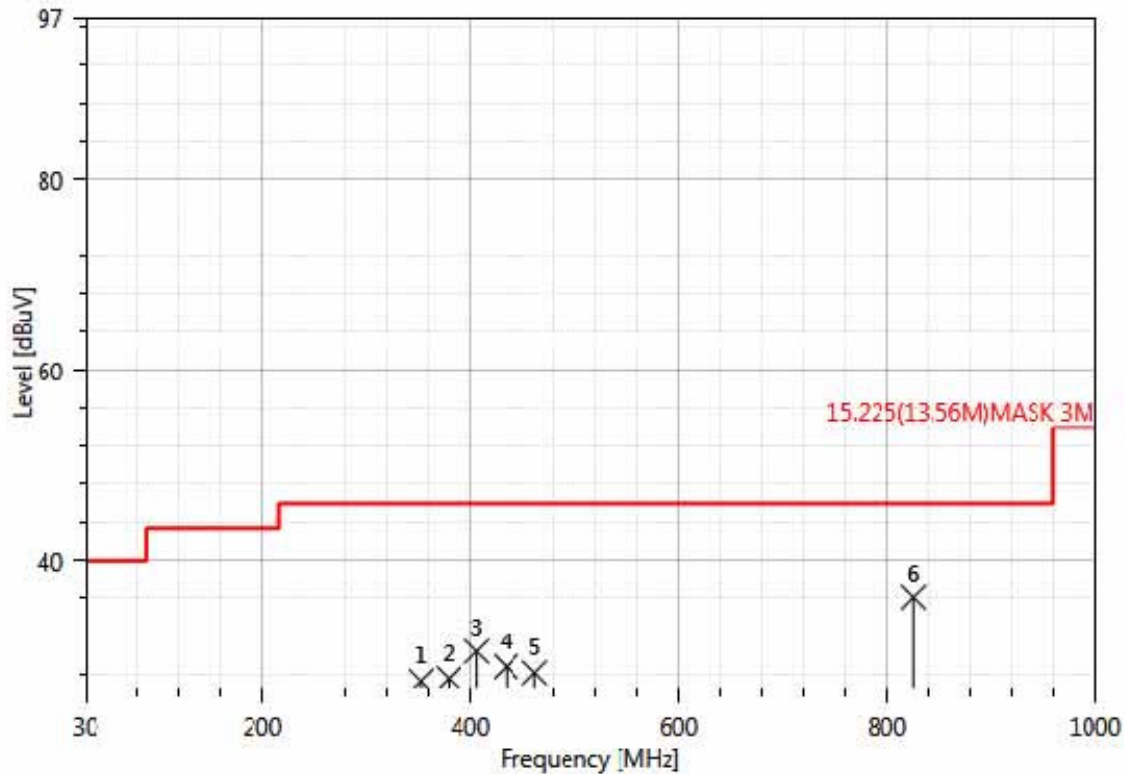
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Operation Band :	Tx	Test Engineer :	Kane
EUT Pol. :	H Plane	Measurement Antenna Pol. :	HORIZONTAL



Freq. MHz	Note F/H/E/S	Decetor Mode QP/AV/PK	Actual Reading Level dBµV/m	Spectrum FS dBµV/m	Factor dB	Limit @3m dBuV/m	Margin dB
353.01	H	Peak	27.41	32.30	-4.90	46.00	-18.59
379.20	H	Peak	27.68	32.09	-4.41	46.00	-18.32
406.36	H	Peak	30.47	34.06	-3.59	46.00	-15.53
434.49	H	Peak	28.91	32.47	-3.56	46.00	-17.09
461.65	H	Peak	28.26	30.86	-2.60	46.00	-17.74
825.40	S	Peak	36.11	32.64	3.46	46.00	-9.89

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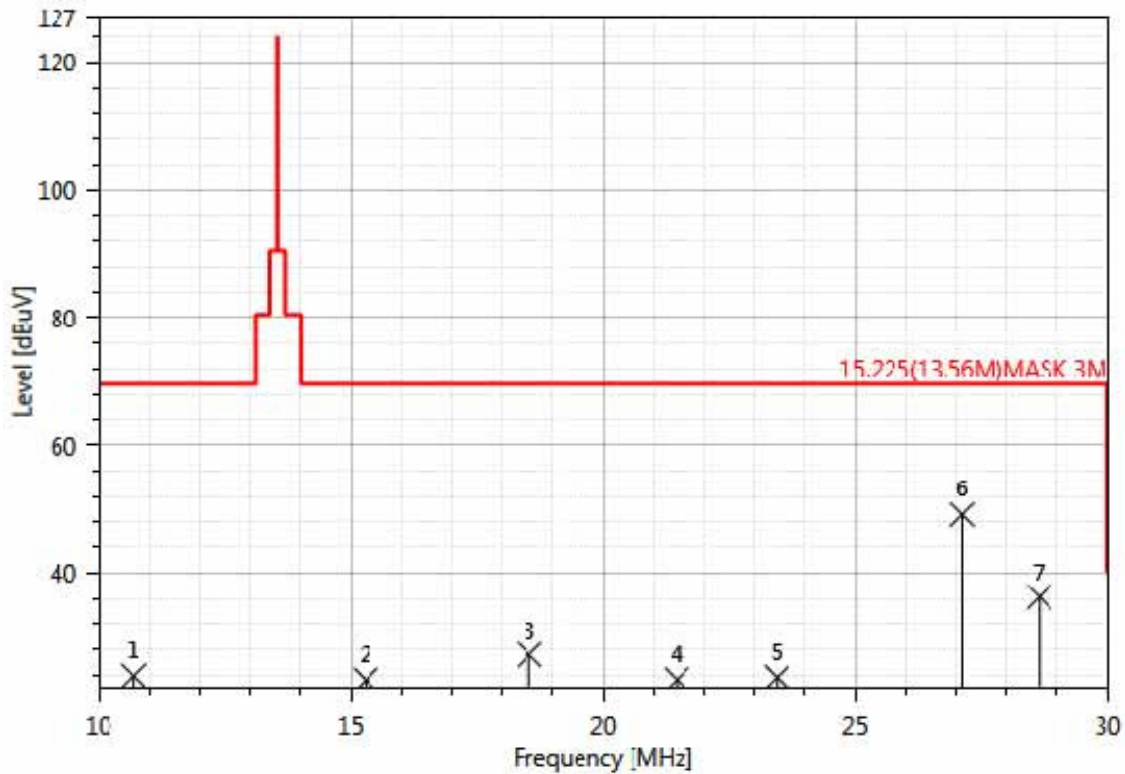
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Operation Mode :	RFID	Test Date :	11/14/2016
Fundamental Frequency :	13.56 MHz	Temp. / Humi. :	23.8 deg_C/59 RH
Operation Band :	Tx	Test Engineer :	Kane
EUT Pol. :	H Plane	Measurement Antenna Pol. :	VERTICAL



Freq. MHz	Note F/H/E/S	Decetor Mode QP/AV/PK	Actual Reading Level dBµV/m	Spectrum FS dBµV/m	Factor dB	Limit @3m dBuV/m	Margin dB
10.70	S	Peak	23.96	12.60	11.36	69.54	-45.58
15.30	S	Peak	23.30	11.83	11.47	69.54	-46.24
18.54	S	Peak	27.22	15.67	11.55	69.54	-42.32
21.46	S	Peak	23.36	12.22	11.14	69.54	-46.18
23.44	S	Peak	23.73	13.14	10.59	69.54	-45.81
27.12	H	Peak	49.23	39.53	9.70	69.54	-20.31
28.64	S	Peak	36.27	26.91	9.36	69.54	-33.27

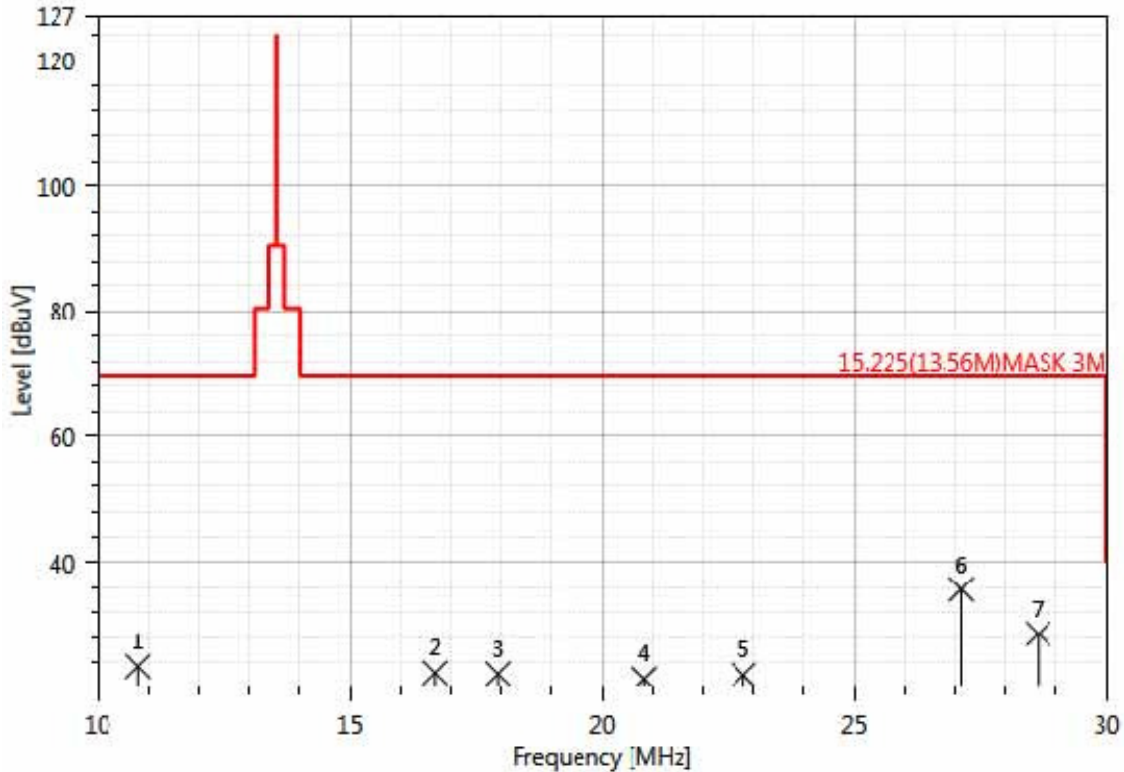
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 Fundamental Frequency : 13.56 MHz Temp. / Humi. : 23.8 deg_C/59 RH
 Operation Band : Tx Test Engineer : Kane
 EUT Pol. : H Plane Measurement Antenna Pol. : HORIZONTAL



Freq. MHz	Note F/H/E/S	Decetor Mode QP/AV/PK	Actual Reading Level dB μ V/m	Spectrum FS dB μ V/m	Factor dB	Limit @3m dBuV/m	Margin dB
10.80	S	Peak	23.40	12.04	11.36	69.54	-46.14
16.70	S	Peak	22.39	10.88	11.50	69.54	-47.15
17.94	S	Peak	22.25	10.72	11.54	69.54	-47.29
20.84	S	Peak	21.44	10.12	11.32	69.54	-48.10
22.80	S	Peak	22.06	11.31	10.76	69.54	-47.48
27.12	H	Peak	35.69	25.99	9.70	69.54	-33.85
28.64	S	Peak	28.59	19.23	9.36	69.54	-40.95

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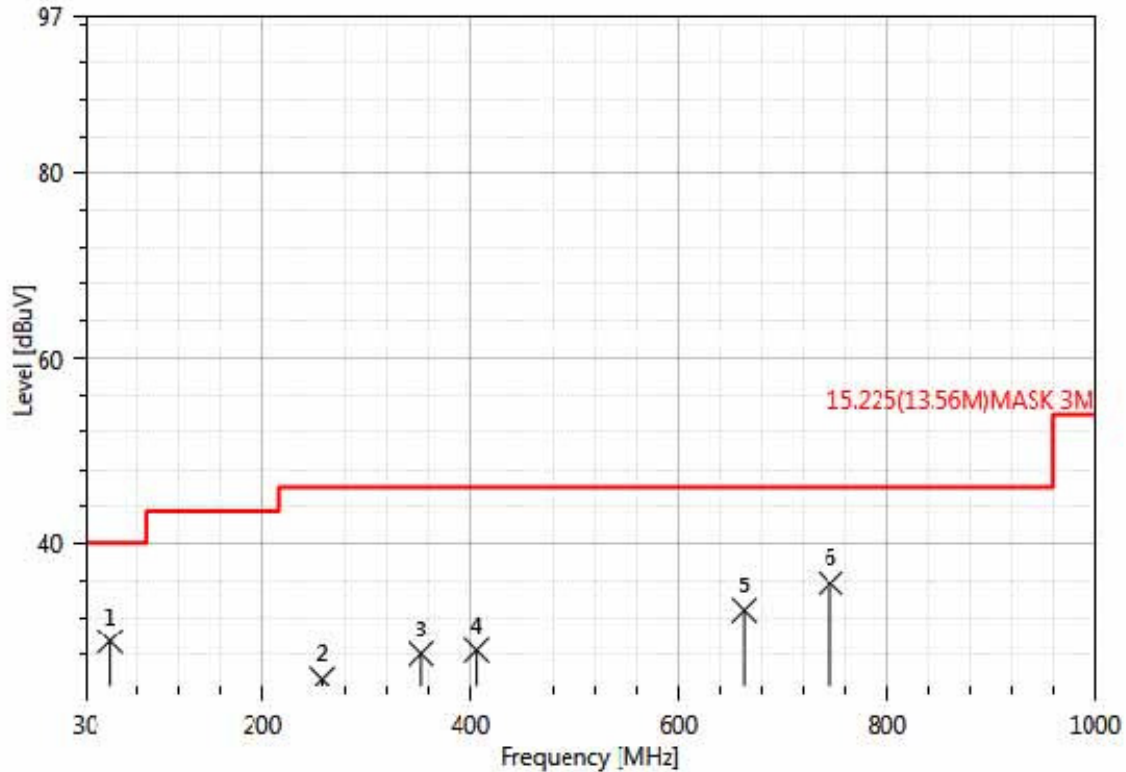
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Fundamental Frequency :	13.56 MHz	Temp. / Humi. :	23.8 deg_C/59 RH
Operation Band :	Tx	Test Engineer :	Kane
EUT Pol. :	H Plane	Measurement Antenna Pol. :	VERTICAL



Freq. MHz	Note F/H/E/S	Decetor Mode QP/AV/PK	Actual Reading Level dB μ V/m	Spectrum FS dB μ V/m	Factor dB	Limit @3m dBuV/m	Margin dB
54.25	H	Peak	29.41	37.23	-7.82	40.00	-10.59
257.95	H	Peak	25.38	32.75	-7.38	46.00	-20.62
353.01	H	Peak	28.06	32.96	-4.90	46.00	-17.94
406.36	H	Peak	28.43	32.02	-3.59	46.00	-17.57
663.41	H	Peak	32.76	32.52	0.24	46.00	-13.24
745.86	H	Peak	35.70	33.40	2.30	46.00	-10.30

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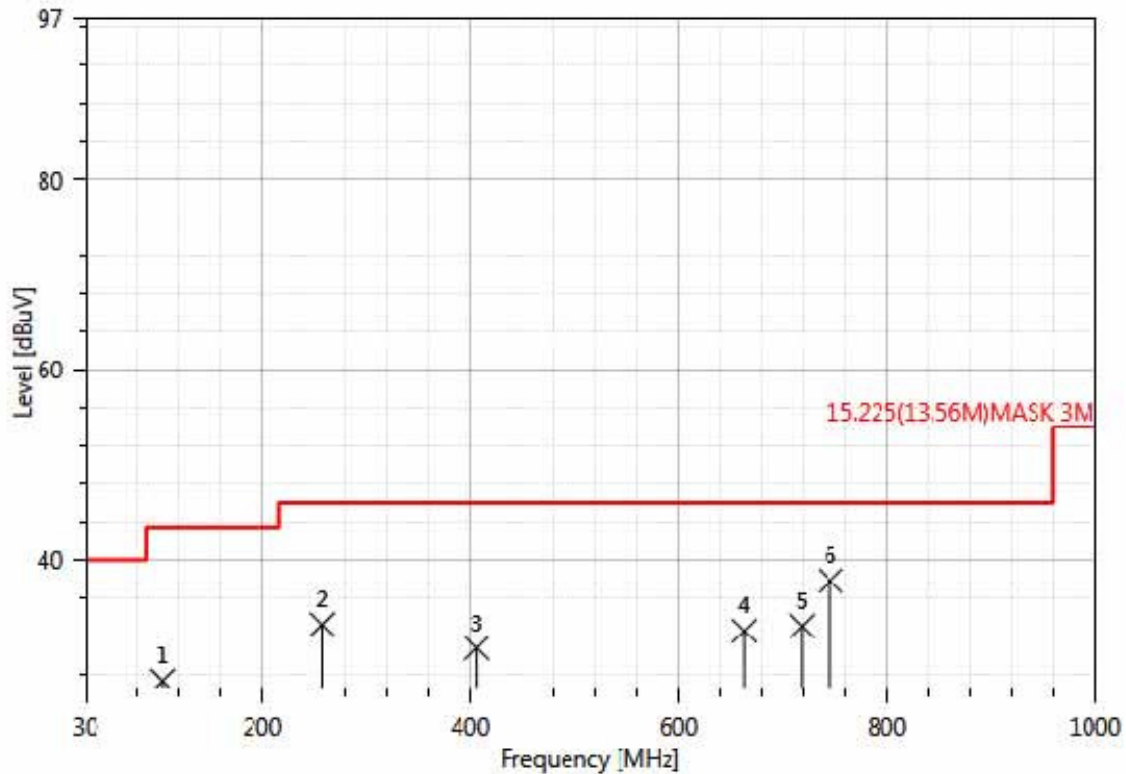
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Freq. MHz	Note F/H/E/S	Decetor Mode QP/AV/PK	Actual Reading Level dB μ V/m	Spectrum FS dB μ V/m	Factor dB	Limit @3m dBuV/m	Margin dB
104.69	S	Peak	27.29	39.24	-11.95	43.50	-16.21
257.95	H	Peak	33.20	40.58	-7.38	46.00	-12.80
406.36	H	Peak	30.73	34.32	-3.59	46.00	-15.27
663.41	H	Peak	32.53	32.29	0.24	46.00	-13.47
718.70	H	Peak	33.04	31.55	1.50	46.00	-12.96
745.86	H	Peak	37.82	35.51	2.30	46.00	-8.18

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8 FREQUENCY STABILITY

8.1 Standard Applicable

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.

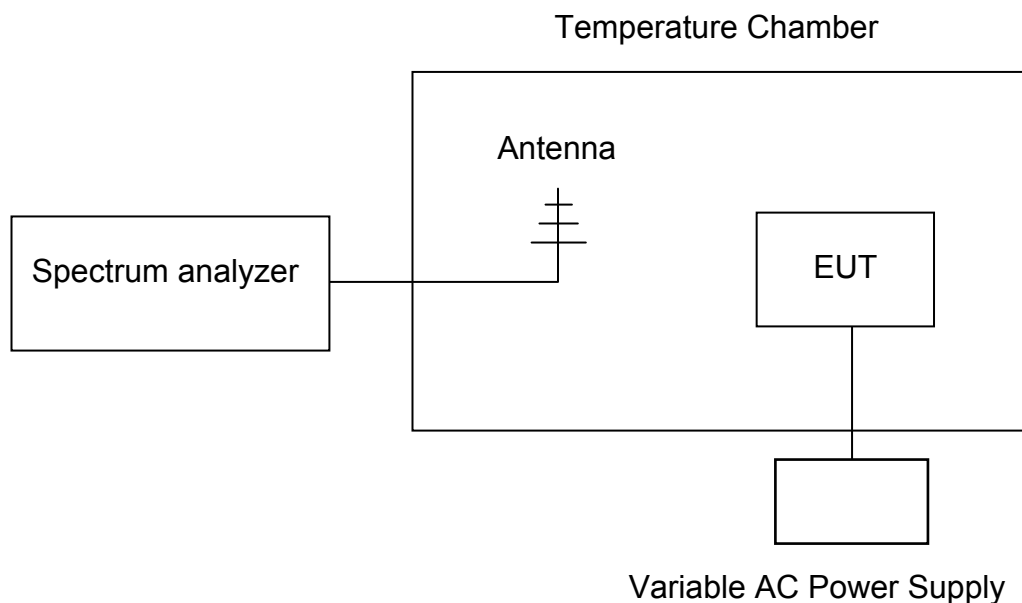
Carrier frequency stability shall be maintained to $\pm 0.01\%$ (± 100 ppm).

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 inside temperature chamber and powered and powered by nominal DC voltage.
2. Set EUT as normal operation.
3. Turn the EUT on and couple its output to spectrum.
4. Turn the EUT off and set the chamber to the highest temperature specified.
5. Allow sufficient time (approximately 30 min) for the temperature of the chamber to stabilize, turn the EUT and measure the operating frequency.
6. Repeat step with the temperature chamber set to the lowest temperature.
7. Set spectrum Center Frequency = fundamental frequency, RBW, VBW= 10 kHz, Span =100 kHz, Detector =Max hold, Mark peak.

8.3 Test SET-UP



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8.4 Measurement Equipment Used

SGS Conducted Room					
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
Power Meter	Anritsu	ML2495A	1005007	12/09/2015	12/08/2016
Power Sensor	Anritsu	MA2411B	917032	12/09/2015	12/08/2016
EXA Spectrum Analyzer	Agilent	N9030A	MY53120760	02/26/2016	02/25/2017
DC Block	Mini-Circuits	BLK-18-S+	1	01/02/2016	01/01/2017
Coaxial Cable	HUBER+SUHNER	SUCOFLEX 102	23670/2	01/02/2016	01/01/2017
Attenuator	Mini-Circuit	BW-S10W2+	2	01/02/2016	01/01/2017
Splitter	Agilent	11636B	N/A	01/02/2016	01/01/2017
DC Power Supply	Agilent	E3640A	MY52410006	11/05/2015	11/04/2016
Temperature Chamber	TERCHY	MHG-120LF	911009	05/17/2016	05/16/2017

8.5 Measurement Results

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A. Temperature Variation

Power Supply Environment Frequency
Vdc Temperature
(

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A. Temperature Variation

Power Supply Vdc	Environment Temperature (Frequency	Delta (Hz)	Limit (kHz)
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9 99% & 20 dB OCCUPIED BANDWIDTH MEASUREMENT

9.1 Standard Applicable:

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

9.2 Limit:

None

9.3 Test Set-up



9.4 Measurement Procedure

1. The transmitter output (antenna port) was connected to the spectrum analyzer in peak mode.
2. 20dB Bandwidth the resolution bandwidth of 1 kHz and the video bandwidth of 3 kHz were used.
3. Measured the spectrum width with power higher than 20dB below carrier.

9.5 Measurement Equipment Used

SGS Conducted Room					
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
Power Meter	Anritsu	ML2495A	1005007	12/09/2015	12/08/2016
Power Sensor	Anritsu	MA2411B	917032	12/09/2015	12/08/2016
EXA Spectrum Analyzer	Agilent	N9030A	MY53120760	02/26/2016	02/25/2017
DC Block	Mini-Circuits	BLK-18-S+	1	01/02/2016	01/01/2017
Coaxial Cable	HUBER+SUHNER	SUCOFLEX 102	23670/2	01/02/2016	01/01/2017
Attenuator	Mini-Circuit	BW-S10W2+	2	01/02/2016	01/01/2017
Splitter	Agilent	11636B	N/A	01/02/2016	01/01/2017
DC Power Supply	Agilent	E3640A	MY52410006	11/05/2015	11/04/2016
Temperature Chamber	TERCHY	MHG-120LF	911009	05/17/2016	05/16/2017

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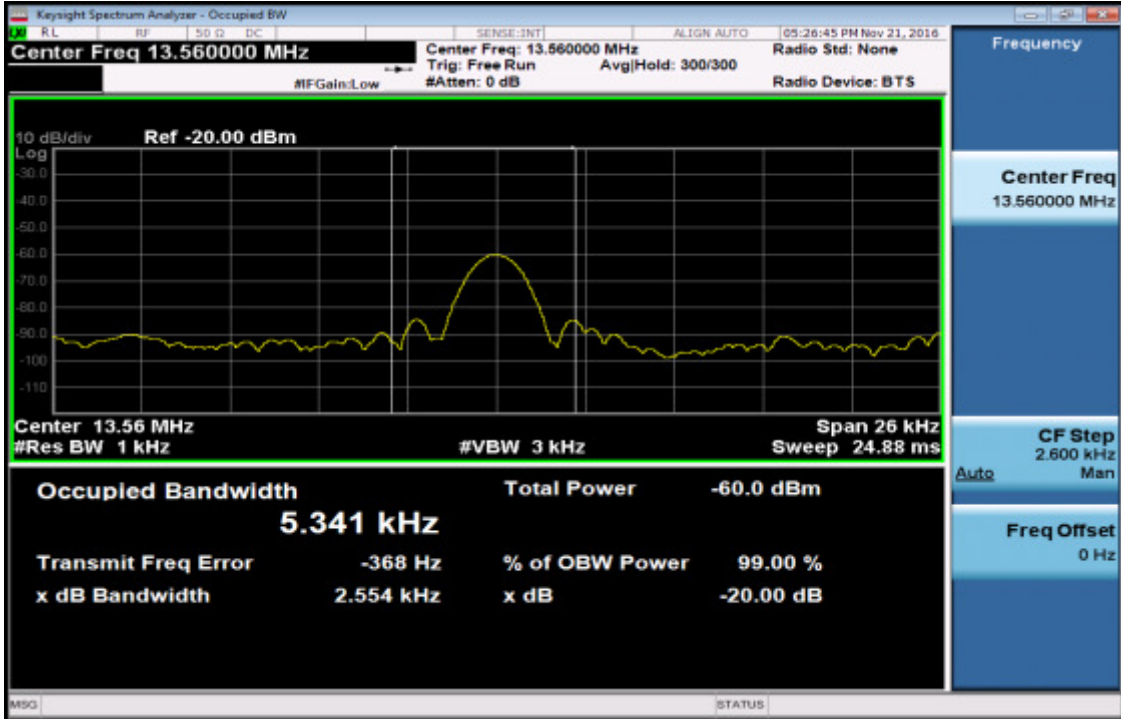
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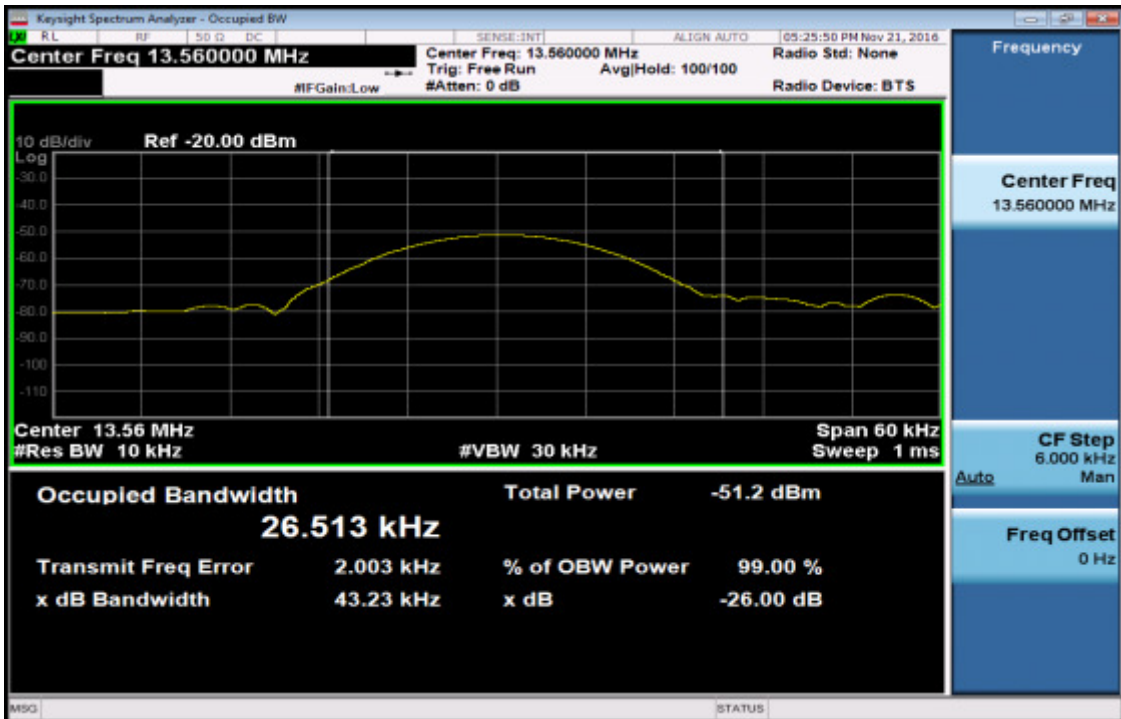
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9.6 Measurement Result

ACON 20dB Bandwidth



99% Bandwidth



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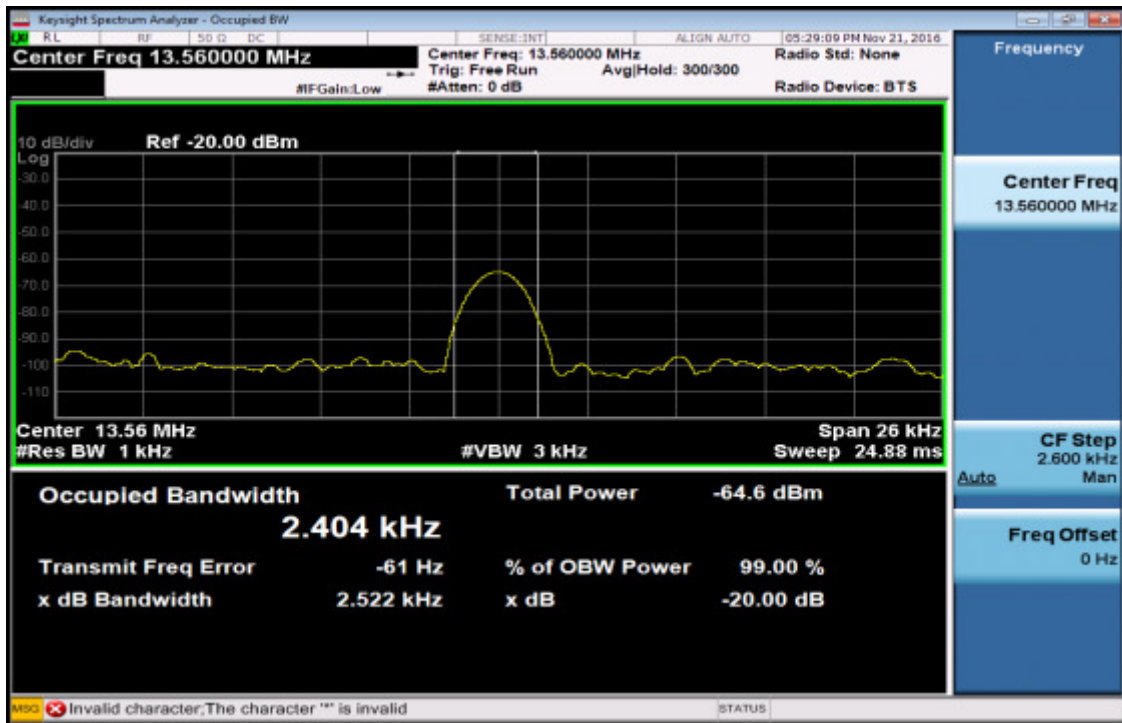
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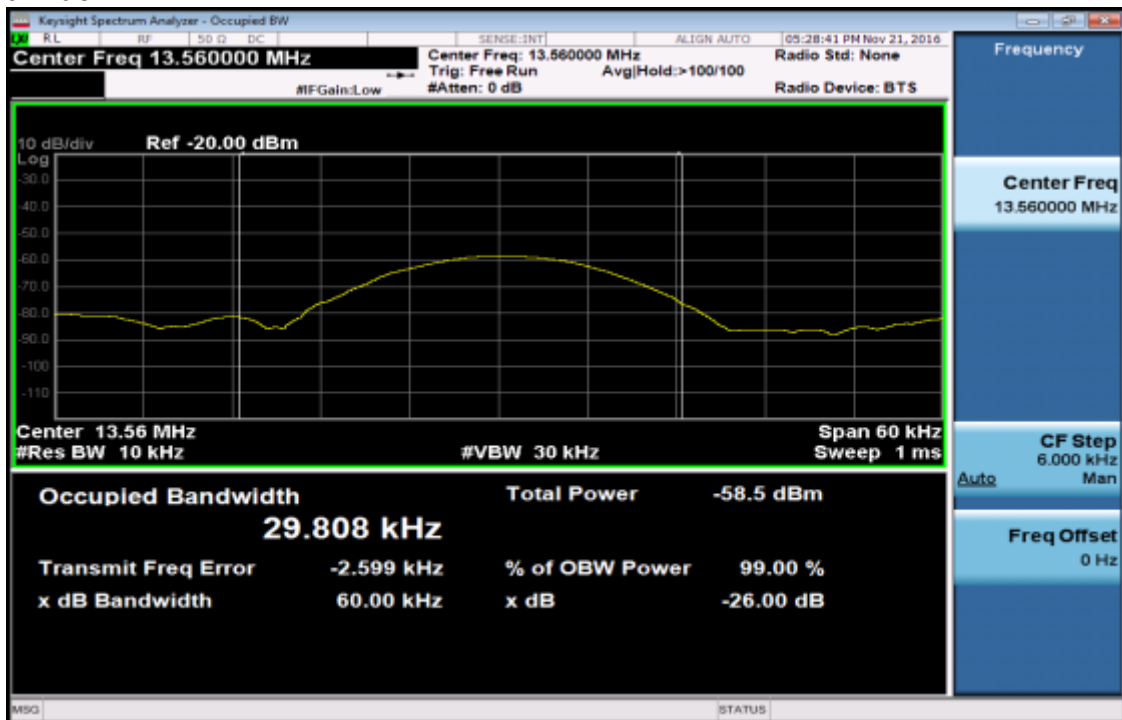
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**YAGEO
20dB Bandwidth**



99% Bandwidth



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10 ANTENNA REQUIREMENT

10.1. Standard Applicable

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 so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of Sections 15.211, 15.213, 15.217, 15.219, or 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with Section 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this Part are not exceeded.

When a measurement at the antenna connector is used to determine RF output power, the effective gain of the device's antenna shall be stated, based on measurement or on data from the antenna manufacturer.

For transmitters of RF output power of 10 milliwatts or less, only the portion of the antenna gain that is in excess of 6 dBi (6 dB above isotropic gain) shall be added to the measured RF output power to demonstrate compliance with the radiated power limits specified in the applicable standard. For transmitters of output power greater than 10 milliwatts, the total antenna gain shall be added to the measured RF output power to demonstrate compliance to the specified radiated power limits.

According to RSS-GEN 8.3

The applicant for equipment certification, as per RSP-100, must provide a list of all antenna types that may be used with the licence-exempt transmitter, indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna.

Licence-exempt transmitters that have received equipment certification may operate with different types of antennas. However, it is not permissible to exceed the maximum equivalent isotropically radiated power (e.i.r.p.) limits specified in the applicable standard (RSS) for the licence-exempt apparatus.

Testing shall be performed using the highest gain antenna of each combination of licence-exempt transmitter and antenna type, with the transmitter output power set at the maximum level.9 When a measurement at the antenna connector is used to determine RF output power, the effective gain of the device's antenna shall be stated, based on a measurement or on data from the antenna manufacturer.

10.2. Antenna Connected Construction

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

~ End of Report ~

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