RF - TEST REPORT

Report Number	:	68.960.15.003.02	Date of Issue	:	May 13, 2015
Issue Version	:	V2.0			
Model	:	MR F77B GPS E, MR F77W GPS E, MR F57B E, MR F57W E			
Product Type	:	VHF Marine Radio			
Applicant	:	Cobra Electronics Corporation			
Address	:	6500 West Cortland Street, Chicago, IL			
Production Facility	:	Cobra Electronics Corporation			
Address	:	6500 West Cortland Street, Chicago, IL			
Test Result	:	■**Positive**	☐**Negative**		
Total pages	:	107			

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1 General Information

1.1 Notes

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EMC Project Engineer	**Date**	**Name**	**Signature**
Approved by	**2015-05-13**	**John Zhi**	John Zhi
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1.2 Details about the Test Laboratory

Test Location 1:	TÜV SÜD Certification and Testing (China) Co., Ltd. Shenzhen Branch
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Test Location 2 :	SHENZHEN HUATONGWEI INTERNATIONAL INSPECTIONAL CO.，LTD.
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1.3 Details of Applicant

Client:	Cobra Electronics Corporation
Address:	6500 West Cortland Street, Chicago, IL
Product Description:	VHF Marine Radio
Manufacturer's Model No.:	MR F77B GPS E, MR F77W GPS E, MR F57B E, MR F57W E

1.4 Application Details

Date of receipt of order:	**May 4, 2015**
Date of receipt of test item:	**May 5, 2015**
Date of test:	**May 5, 2015** - **May 12, 2015**

1.5 Applied Standards

Test Standards
IEC 62238:2003 Maritime navigation and radiocommunication equipment and systems –VHF radiotelephone equipment incorporating Class "D" Digital Selective Calling (DSC) – Methods of testing and required test results
ETSI EN 301 025-1 V1.5.2 Electromagnetic compatibility and Radio spectrum Matters (ERM); VHF radiotelephone equipment for general communications and associated equipment for Class "D" Digital Selective Calling (DSC); Part 1: Technical characteristics and methods of measurement
ETSI EN 301 025-2 V1.5.1 Electromagnetic compatibility and Radio spectrum Matters (ERM); VHF radiotelephone equipment for general communications and associated equipment for Class "D" Digital Selective Calling (DSC); Part 2: Harmonized EN covering the essential requirements of article 3.2 of the R&TTE Directive

1.6 Normal end Extreme Environmental and Rating conditions

During the measurement the environmental conditions were within the listed ranges:

Relative Humidity:	20~75 %	Air Pressure:	950~1050mba
Normal Temperature T_{nom}	15~35°C	Rated voltage V_{nom}	DC 13.8V
Extreme Temperature T_{max} :	+55ºC	Extreme Voltage V_{max}	DC 17.94V
Extremel Temperature T_{min} :	-15 ºC	Extreme Voltage V_{min}	DC 12.42V

1.7 Summary of Test Results

Technical Requirements				
IEC62238 & ETSI EN 301 025-2 V1.5.1				
Test description	Limit EN 301 025-2	Tested method: IEC62238 & EN 301 025-1	Test Site	Test Result
Transmitter frequency error clause 5.3.1	4.2.1	8.1	Site 1	Pass
Transmitter adjacent channel power clause 5.3.2	4.2.2	8.7	Site 1	Pass
Transmitter conducted spurious emissions conveyed to the antenna clause 5.3.3	4.2.3	8.8	Site 1	Pass
Transmitter cabinet radiation and conducted spurious emissions other than those conveyed to the antenna clause 5.3.4	4.2.4	8.9	Site 1	Pass
Transient frequency behaviour of the transmitter clause 5.3.5	4.2.5	8.10	Site 1	Pass
Transmitter carrier power clause 5.3.6	4.2.6	8.2	Site 1	Pass
Transmitter frequency deviation clause 5.3.7	4.2.7	8.3	Site 1	Pass
DSC frequency error (demodulated DSC signal) clause 5.3.8	4.2.8	8.12	Site 1	Pass
DSC modulation index clause 5.3.9	4.2.9	8.13	Site 1	Pass
DSC modulation rate clause 5.3.10	4.2.10	8.14	Site 1	Pass
Receiver maximum useable sensitivity clause 5.4.2	4.2.11	9.3	Site 1	Pass
Receiver co-channel rejection clause 5.4.3	4.2.12	9.4	Site 1	Pass

Receiver adjacent channel selectivity clause 5.4.4	4.2.13	9.5	Site 1	Pass
Receiver spurious response rejection clause 5.4.5	4.2.14	9.6	Site 1	Pass
Receiver inter-modulation response clause 5.4.6	4.2.15	9.7	Site 1	Pass
Receiver blocking or desensitization clause 5.4.7	4.2.16	9.8	Site 1	Pass
Receiver spurious emissions at the antenna clause 5.4.8	4.2.17	9.9	Site 1	Pass
Receiver cabinet radiated spurious emissions clause 5.4.9	4.2.18	9.10	Site 1	Pass
DSC receiver maximum useable sensitivity clause 5.4.10	4.2.19	10.1	Site 1	Pass
DSC receiver co-channel Rejection clause 5.4.11	4.2.20	10.2	Site 1	Pass
DSC receiver spurious response and blocking immunity clause 5.4.12	4.2.21	10.4	Site 1	Pass

Summary of major differences of IEC 62238 standard from existing regional ETSI EN 301 025 standards

C.1 European Standard EN 301 025

EN 301 025, Electromagnetic compatibility and Radio Spectrum Matters (ERM); Technical characteristics and methods of measurement for VHF radiotelephone equipment for general communications and associated equipment for Class “D” Digital Selective Calling (DSC).

• The requirement for a dedicated channel 70 watchkeeping receiver for DSC decoder has been replaced by a channel 70 watchkeeping facility in order to permit alternative design methods. This facility, however, is still required to achieve continuous DSC monitoring (except when the transmitter is in use). A new test has been added to test that DSC reception is achieved simultaneously with radiotelephone reception.

• The requirement for a Numeric Keypad has been replaced by a more general means of easily entering a MMSI to allow more flexibility in design.

• The requirement for the transmitter to work for 30 min continuously in the high power transmit condition has been replaced by a period of 5 min to permit the use of a lower cost transmitter. Facilities have also been added to limit transmission time to 5 min.

• The requirement to protect information in volatile memories from interruptions in the power supply of up to 60 s duration has been removed as not being of practical benefit.

• A requirement to transmit and receive enhanced position information with a distress call has been added.

• EMC requirements have been added.

2 Equipment Specification

2.1 General Description

Figure 1. MR F77B Appearance

2.2 Description of the Equipment Under Test

Name of EUT:	VHF Marine Radio	
Trade mark:	Cobra	
Model/Type reference:	MR F77B GPS	
Listed mode(s):	MR F77W GPS, MR F57B, MR F57W	
Power supply:	DC 13.8V	
Charger information:	/	
Adapter information:	/	
Operation Frequency Range:	From 156.050 MHz to 157.425 MHz	
Rated Output Power:	25 Watts(43.98dBm)/1Watts(30.00dBm)	
Modilation Type:	Analog Voice:	FM
	Digital Voice/Digital Data:	FSK
Channel Separation:	Analog Voice:	25 KHz
	Digital Data:	25 KHz
Emission Designator:	Analog Voice:	16K0G3E for 25KHz Channel Separation
	Digital Voice:	/
	Digital Data:	16K0G2B
Antenna Type	External (Marine Antenna vertically polarized on board ship)	

2.3 Test frequency list

Conformance tests for 25 kHz channel operation shall be made on channel 16. (Tx/Rx = 156.80 MHz)
Conformance tests for 12,5 kHz channel operation shall be made on channel 276.
Conformance tests for DSC operation shall be made on channel 70.(Rx only = 156.525 MHz)

2.4 EUT operation mode

Operation mode	Description of operation mode	Additional information
Op 1	FM+BW25KHz +TX max	The equipment is set with FM modulation and 25KHz bandwidth at maximum rated power for transmitter,
Op 2	FM+BW25KHz +TX min	The equipment is set with FM modulation and 25KHz bandwidth at minimum rated power for transmitter,
Op 3	FM+BW25KHz +RX	The equipment is set with FM modulation and 25KHz bandwidth at receiver or standby, V

2.5 EUT ancillary device configuration

The following peripheral devices and interface cables were connected during the measurement:

- ● - supplied by the manufacturer
- ○ - supplied by the lab

●	Power Cable	Length (m) :	1.00
		Shield :	Unshielded
		Detachable :	Undetachable
○	MultiMate	Manufacturer :	/
		Model No. :	/

2.6 Test Equipment List per Test Site

2.6.1 Equipments Used during the Test site -1

2.6.1.1 Frequency Deviation

Item	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal.
1	RF COMMUNICATION TEST SET	HP	8920A	3813A10206	2015-11-01

2.6.1.2 Unwanted emissions in the spurious domain

Item	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal.
1	EMI TEST RECEIVER	Rohde&Schwarz	ESI 26	100009	2015-11-01
2	EMI TEST SOFTWARE	Audix	E3	N/A	N/A
3	RF COMMUNICATION TEST SET	HP	8920A	3813A10206	2015-11-01
4	High-Pass Filter	Anritsu	MP526D	6220878392	2015-11-01
5	Ultra-Broadband Antenna	ShwarzBeck	VULB9163	538	2015-11-01
6	Ultra-Broadband Antenna	ShwarzBeck	VULB9163	539	2015-11-01
7	HORN ANTENNA	ShwarzBeck	9120D	1011	2015-11-01
8	HORN ANTENNA	ShwarzBeck	9120D	1012	2015-11-01
9	TURNTABLE	MATURO	TT2.0	----	N/A
10	ANTENNA MAST	MATURO	TAM-4.0-P	----	N/A

11	SPECTRUM ANALYZER	Agilent	E4407B	MY44210775	2015/11/1

2.6.1.3 Frequency Error & Carrier power (Conducted)					
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal.
1	Receiver	Rohde&Schwarz	ESIB26	100009	2015-11-01
2	Climate Chamber	ESPEC	EL-10KA	05107008	2015-11-01
3	RF COMMUNICATION TEST SET	HP	8920A	3813A10206	2015-11-01

2.6.1.4 Adjacent Channel Power					
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal.
1	Receiver	Rohde&Schwarz	ESI26	100009	2015-11-01
2	RF COMMUNICATION TEST SET	HP	8920A	3813A10206	2015-11-01

2.6.1.5 Maximum Usable Sensitivity					
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal.
1	Climate Chamber	ESPEC	EL-10KA	05107008	2015-11-01
2	RF COMMUNICATION TEST SET	HP	8920A	3813A10206	2015-11-01

2.6.1.6 Adjacent Channel Selectivity					
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal.
1	Signal Generator	Rohde&Schwarz	SMT03	100059	2015-11-01
2	Climate Chamber	ESPEC	EL-10KA	05107008	2015-11-01
3	RF COMMUNICATION TEST SET	HP	8920A	3813A10206	2015-11-01

2.6.1.7 Co-channel rejection & Spurious Response Rejection & Inter Modulation Response Rejection & Blocking or Desensitization					
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal.
1	Signal Generator	Rohde&Schwarz	SMT03	100059	2015-11-01
2	Signal Generator	IFR	2032	203002/100	2015-11-01
3	RF COMMUNICATION TEST SET	HP	8920A	3813A10206	2015-11-01

The Cal. Interval was one year

2.7 Measurement System Uncertainty

Measurement System Uncertainty Emissions

Hereafter the best measurement capability for < test site 1> is reported:

System Measurement Uncertainty		
Test Items	Measurement Uncertainty	Notes
Frequency error	25 Hz	(1)
Transmitter power conducted	0.57 dB	(1)
Transmitter power Radiated	2.20 dB	(1)
Adjacent and alternate channel power Conducted	1.20 dB	(1)
Conducted spurious emission 9KHz-12.75 GHz	1.60 dB	(1)
Radiated spurious emission 9KHz-12.75 GHz	2.20 dB	(1)
Intermodulation attenuation	1.00 dB	(1)
Maximum useable receiver sensitivity	2.80 dB	(1)
Co-channel rejection	2.80 dB	(1)
Adjacent channel selectivity	2.80 dB	(1)
Spurious response rejection	2.80 dB	(1)
Intermodulation response rejection	2.80 dB	(1)
Blcking or desensitization	2.80 dB	(1)

(1) This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=1.96.

Hereafter the best measurement capability for <test site 2> is reported:

System Measurement Uncertainty		
Items		**Extended Uncertainty**
Radiated Emissions	Level accuracy 30 to 200 MHz 200 to 1000 MHz 1000 to 6000 MHz	±5.09 dB ±5.06 dB ±5.10 dB
Conducted emissions	Level accuracy 9 kHz to 30 MHz	±2.48 dB

3ETSI EN 301 025-2 Transmitter Requirements

3.1 Transmitter Frequency Error

3.1.1 Definition

Frequency error is the difference between the measured carrier frequency and its nominal value.

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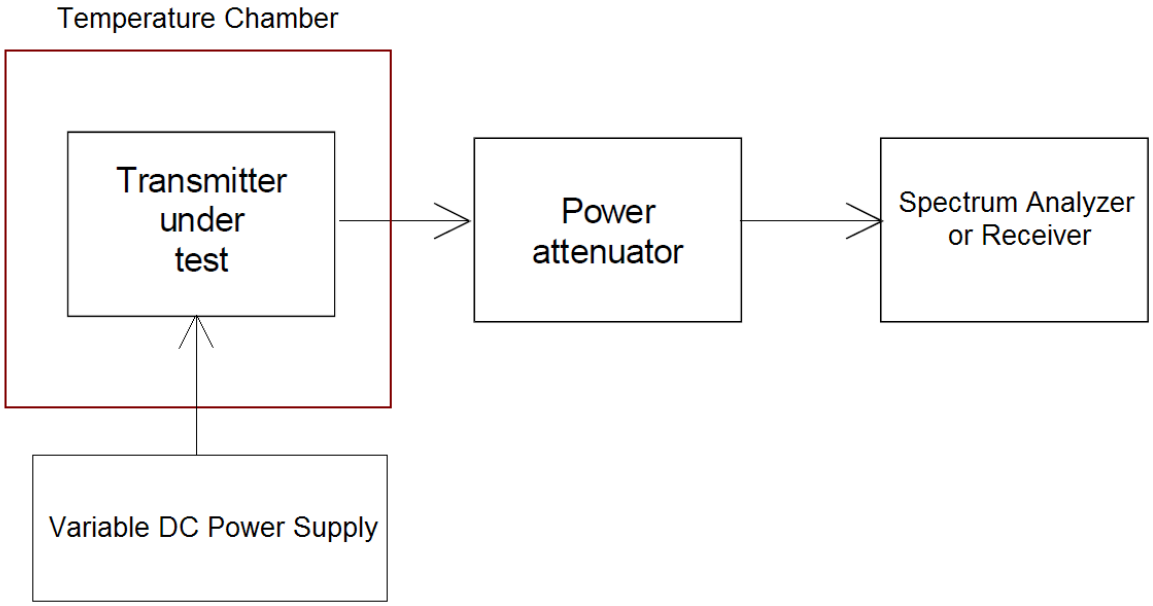
3.1.2 TEST CONFIGURATION



3.1.3 TEST PROCEDURE

ETSI EN 301 025-1Sub-clause 8.1.2 : The carrier frequency shall be measured in the absence of modulation, with the transmitter connected to an artificial antenna non-reactive, non-radiating 50 Ω (see clause 6.5) and tuned to channel 16.

Measurements shall be made under normal test conditions and under extreme test conditions.

This test shall be carried out with the output power switch being set at both maximum and minimum.

3.1.4 LIMIT

The frequency error shall be within ±1,5 kHz.

3.1.5 Test result

Operation Mode	Test Conditions		Frequency Error (KHz)			Limit (KHz)	Result
	Temperature (℃)	Voltage(V)	156.05 (MHz)	156.8 (MHz)	157.425 (MHz)		
High Power	25	13.8	-0.064	-0.065	-0.064	±1.5	Pass
	-15	17.94	-0.064	-0.064	-0.064		
		12.42	-0.064	-0.065	-0.064		
	55	17.94	-0.065	-0.065	-0.065		
		12.42	-0.064	-0.065	-0.064		
Low Power	25	13.8	-0.064	-0.064	-0.065		Pass
	-15	17.94	-0.064	-0.064	-0.064		
		12.42	-0.063	-0.064	-0.065		
	55	17.94	-0.064	-0.065	-0.065		
		12.42	-0.064	-0.064	-0.065		

3.1.6 Result

The equipment met the requirement of this clause.

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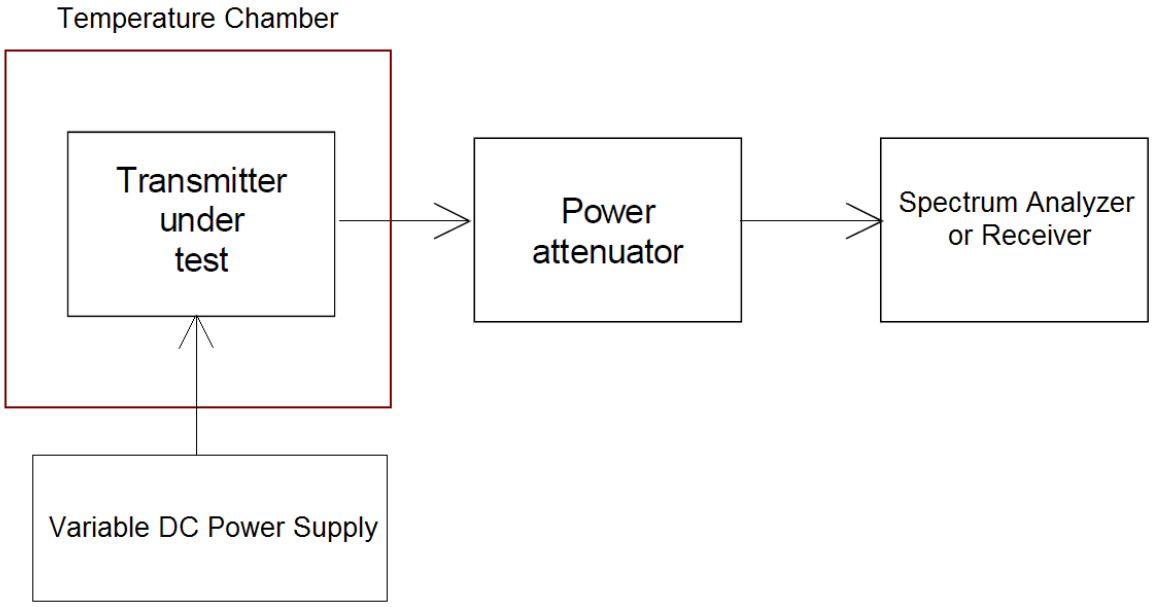
3.2 Transmitter Carrier Power

3.2.1 Definition

Transmitter power (conducted) is the mean power delivered to the artificial antenna during a radio frequency cycle, in the absence of modulation. The rated output power is the carrier power declared by the manufacturer.

3.2.2 TEST CONFIGURATION



3.2.3 TEST PROCEDURE

ETSI EN 301 025-1Sub-clause 8.2.2 : The transmitter shall be connected to an artificial antenna and the power delivered to this artificial antenna shall be measured. The measurements shall be made on channel 16, the highest frequency channel and the lowest frequency channel under normal test conditions (see clause 6.13) and channel 16 under extreme test conditions (clauses 6.14.1 and 6.14.2 applied simultaneously).
During the test on channel 16, a check should be made that the power output falls to zero after the maximum continuous transmission time has elapsed (see clause 4.4)..

3.2.4 LIMIT

Normal conditions :
With the output power switch set at maximum, the carrier power shall remain between 6 W and 25 W and be within ±1,5 dB of the rated output power under normal test conditions. The output power shall never however exceed 25 W.
With the output power switch set at minimum the carrier power shall remain between 0,1 W and 1 W.
The maximum continuous transmission time shall be between 5 min and 6 min.
Extreme conditions :
With the output power switch set at maximum, the carrier power shall remain between 6 W and 25 W and be within +2 dB, -3 dB of the rated output power under extreme conditions. The output power shall never however exceed 25 W.
With the output power switch set at minimum the carrier power shall remain between 0,1 W and 1 W.
The maximum continuous transmission time shall be between 5 min and 6 min.

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3.2.5 Test result

For Rated High Power

Temperature (℃)	Voltage (V)	Test Frequency (MHz)	Measured power (dBm)	Difference (dB)	Limit (dB)	Result
25	13.8	156.05	43.74	-0.24	±1.5	Pass
		156.8	43.65	-0.33		
		157.425	43.71	-0.27		
-15	17.94	156.05	43.67	-0.31	-3 ~ +2	
		156.8	43.60	-0.38		
		157.425	43.55	-0.43		
	12.42	156.05	43.42	-0.56		
		156.8	43.42	-0.56		
		157.425	43.42	-0.56		
55	17.94	156.05	43.67	-0.31		
		156.8	43.61	-0.37		
		157.425	43.55	-0.43		
	12.42	156.05	43.42	-0.56		
		156.8	43.42	-0.56		
		157.425	43.42	-0.56		

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For Rated Low Power

Temperature (℃)	Voltage (V)	Test Frequency (MHz)	Measured power (dBm)	Difference (dB)	Limit (dB)	Result
25	13.8	156.05	29.72	-0.28	±1.5	Pass
		156.8	29.41	-0.59		
		157.425	29.68	-0.32		
-15	17.94	156.05	29.48	-0.52	-3 ~ +2	
		156.8	29.47	-0.53		
		157.425	29.40	-0.60		
	12.42	156.05	29.37	-0.63		
		156.8	29.32	-0.68		
		157.425	29.24	-0.76		
55	17.94	156.05	29.48	-0.52		
		156.8	29.47	-0.53		
		157.425	29.40	-0.60		
	12.42	156.05	29.37	-0.63		
		156.8	29.32	-0.68		
		157.425	29.25	-0.75		

3.2.6 Result

The equipment met the requirement of this clause.

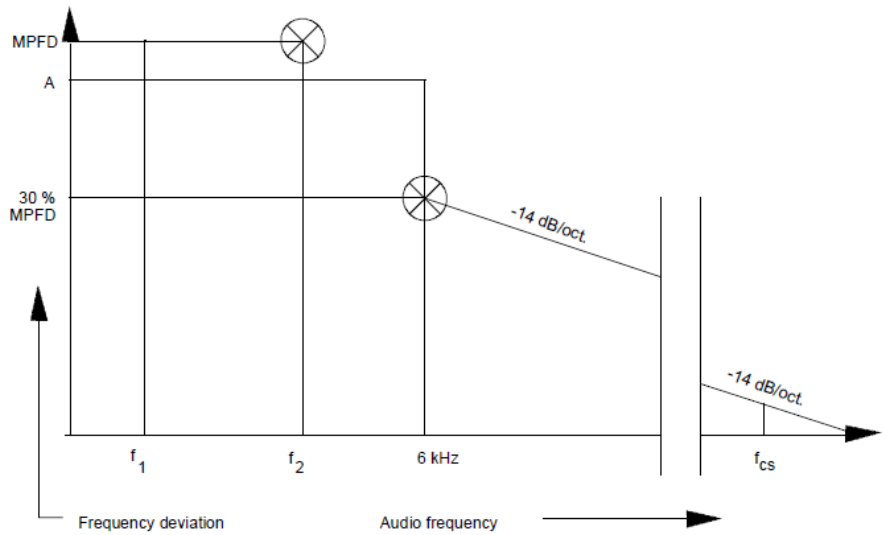
3.3 Transmitter Frequency deviations

3.3.1 Definition

Frequency deviation is the maximum difference between the instantaneous frequency of the modulated radio frequency signal and the carrier frequency in the absence of modulation.
The maximum permissible frequency deviation is the maximum value of frequency deviation stated for the relevant channel separation.

3.3.2 LIMIT

The frequency deviation at modulation frequencies between 3,0 kHz (for equipment operating with 25 kHz channel separations) or 2,55 kHz (for equipment operating with 12,5 kHz channel separation) and 6,0 kHz shall not exceed the frequency deviation at a modulation frequency of 3,0 kHz/2,55 kHz. At 6,0 kHz the deviation shall be not more than 30,0 % of the maximum permissible frequency deviation.
The frequency deviation at modulation frequencies between 6,0 kHz and a frequency equal to the channel separation for which the equipment is intended shall not exceed that given by a linear representation of the frequency deviation (dB) relative to the modulation frequency, starting at the 6,0 kHz limit and having a slope of -14,0 dB per octave. These limits are illustrated in figure 1.



NOTE:
Abbreviations:

f_1	lowest appropriate frequency
f_2	3,0 kHz (for 25 kHz channel separation), or 2,55 kHz (for 12,5 kHz channel separation)
MPFD	maximum permissible frequency deviation, clause 8.3.2.1
A	measured frequency deviation at f_2
f_{cs}	frequency equal to channel separation

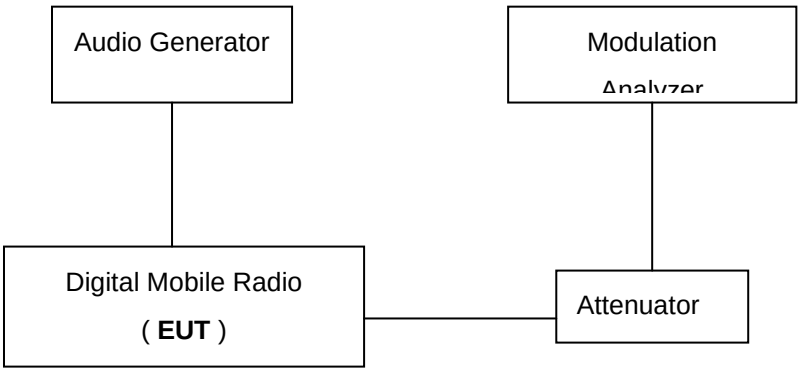
Figure 1: Frequency deviation

3.3.3 TEST PROCEDURE

ETSI EN 301 025-1Sub-clause 8.3.2 : The transmitter shall operate under normal test conditions connected to a 50 Ω resistive, no raditive load (clause 6.5). The transmitter shall be modulated by the normal test modulation (25 kHz channels: 1 kHz and the frequency deviation shall be ±3 kHz. 12,5 kHz channels: 1 kHz and the frequency deviation shall be ±1,5 kHz. - clause 6.4). With the input level of the modulation signal being kept constant, the modulation frequency shall be varied between 3 kHz (see note) and a frequency equal to the channel separation for which the equipment is intended and the frequency deviation shall be measured.

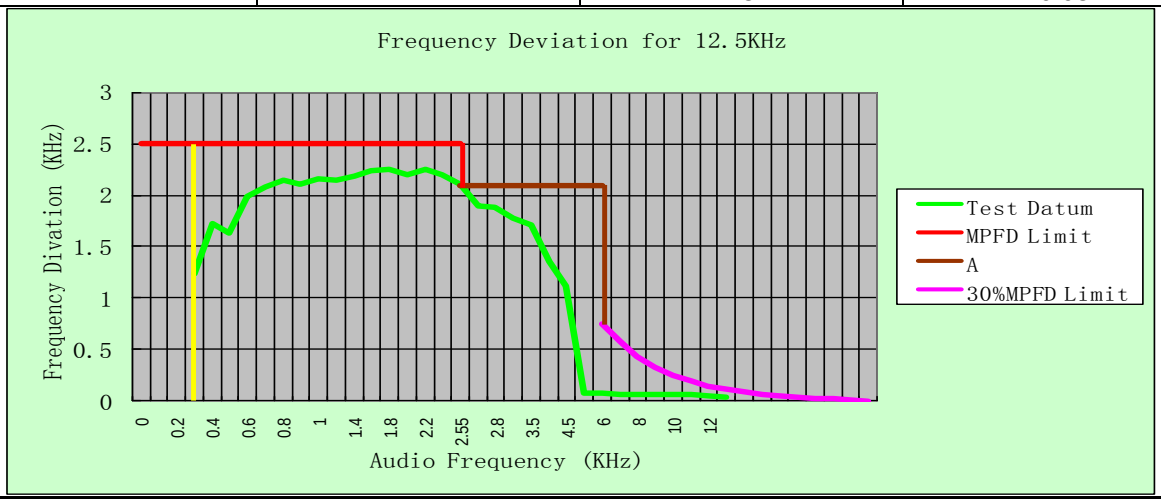
NOTE: 2,55 kHz for transmitters intended for 12,5 kHz channel separation.LIMIT

3.3.4 TEST CONFIGURATION



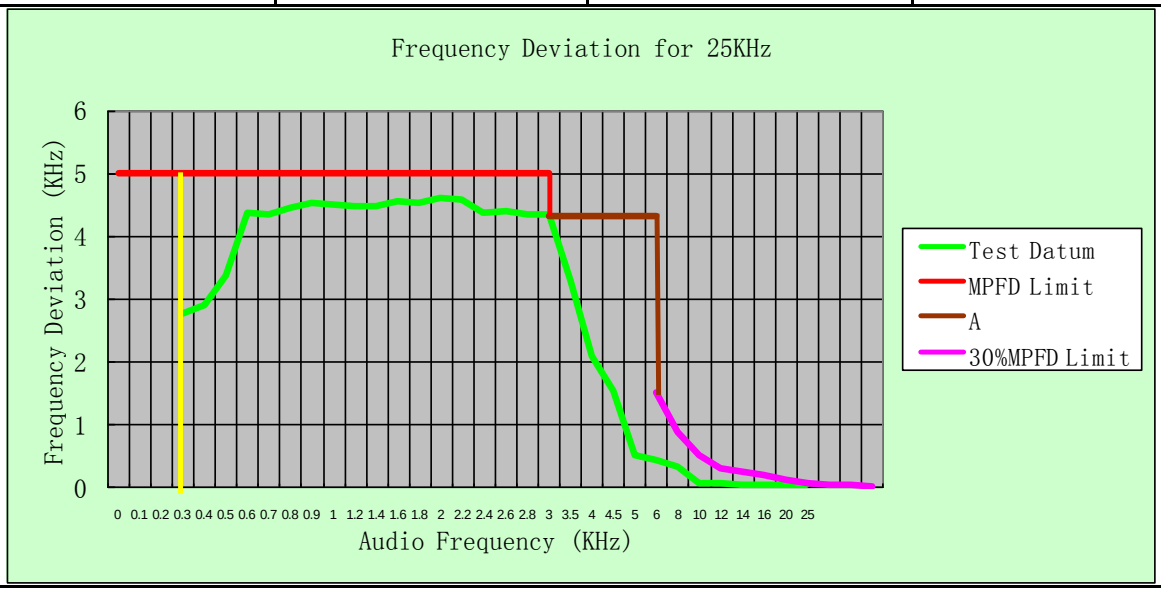
3.3.5 Test result

Op1 (25 KHz channel)			
Modulation Frequency (KHz)	Frequency Deviation (KHz)	Modulation Frequency (KHz)	Frequency Deviation (KHz)
0.1	1.099	2.6	4.72
0.2	2.888	2.8	4.612
0.3	4.409	3	4.472
0.4	4.64	3.5	3.871
0.6	4.865	4	2.601
0.8	4.726	4.5	1.656
0.9	4.706	5	1.071
1	4.683	6	0.498
1.2	4.53	8	0.142
1.4	4.347	10	0.071
1.6	4.261	12	0.059
1.8	4.305	14	0.052
2	4.42	16	0.05
2.2	4.596	20	0.05
2.4	4.714	25	0.05



Op2 (25 KHz channel)			
Modulation Frequency (kHz)	Frequency Deviation (kHz)	Modulation Frequency (kHz)	Frequency Deviation (kHz)

0.1	1.099	2.6	4.72
0.2	2.888	2.8	4.612
0.3	4.409	3	4.472
0.4	4.64	3.5	3.871
0.6	4.865	4	2.601
0.8	4.726	4.5	1.656
0.9	4.706	5	1.071
1	4.683	6	0.498
1.2	4.53	8	0.142
1.4	4.347	10	0.071
1.6	4.261	12	0.059
1.8	4.305	14	0.052
2	4.42	16	0.05
2.2	4.596	20	0.05
2.4	4.714	25	0.05



3.3.6 Result

The equipment met the requirement of this clause.

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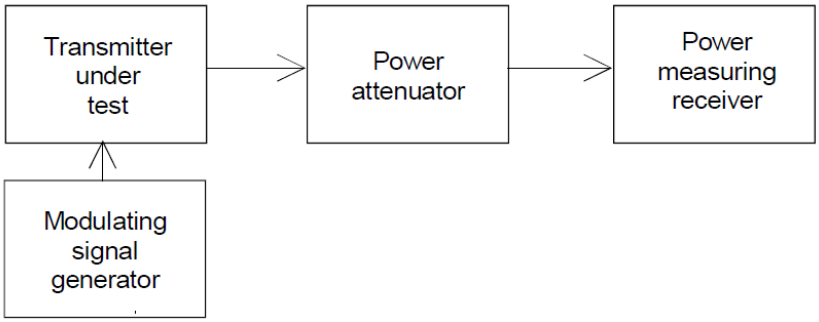
3.4 Transmitter adjacent channel power

3.4.1 Definition

The adjacent channel power is that part of the total power output of a transmitter under defined conditions of modulation which falls within a specified passband centred on the nominal frequency of either of the adjacent channels.
This power is the sum of the mean power produced by the modulation hum and noise of the transmitter..

3.4.2 TEST CONFIGURATION



3.4.3 TEST PROCEDURE

ETSI EN 301 025-1Sub-clause 8.7.2
The adjacent channel power can be measured with a power measuring receiver which conforms to annex B (referred to in clause 8.7.2 and annex B as the "receiver"), in Recommendation ITU-R SM.332-4 [i.3]:
a) The transmitter shall be operated at the carrier power determined in clause 8.2 under normal test conditions. The output of the transmitter shall be linked to the input of the "receiver" by a connecting device such that the impedance presented to the transmitter is 50 Ω and the level at the "receiver" input is appropriate.
b) With the transmitter unmodulated, the tuning of the "receiver" shall be adjusted so that a maximum response is obtained. This is the 0 dB response point. The "receiver" attenuator setting and the reading of the meter shall be recorded.
The measurement may be made with the transmitter modulated with normal test modulation, in which case this fact shall be recorded with the test results.
c) The tuning of the "receiver" shall be adjusted away from the carrier so that the "receiver" -6 dB response nearest to the transmitter carrier frequency is located at a displacement from the nominal carrier frequency of 17 kHz for 25 kHz channels or 8,25 kHz for 12,5 kHz channels.
d) The transmitter shall be modulated with 1,25 kHz at a level which is 20 dB higher than that required to produce ±3 kHz deviation for 25 kHz channels or ±1,5 kHz deviation for 12,5 kHz channels.
e) The "receiver" variable attenuator shall be adjusted to obtain the same meter reading as in step b) or a known relation to it.
f) The ratio of adjacent channel power to carrier power is the difference between the attenuator settings in steps b) and e), corrected for any differences in the reading of the meter.
g) The measurement shall be repeated with the "receiver" tuned to the other side of the carrier. This test shall be carried out with the output power switch being set at both maximum and minimum.

3.4.4 LIMIT

The adjacent channel power shall not exceed a value of:

- 25 kHz channel: 70 dB below the carrier power of the transmitter without any need to be below 0,2 µW.
- 12,5 kHz channel: 60 dB below the carrier power of the transmitter without any need to be below 0,2 µW.

3.4.5 Test result

High Power				
Test Frequency (MHz)	Test Channel	Measurement Power (dBc)	Limit (dB)	Result
156.05	Lower adjacent	-71.16	≤-70	Pass
	Upper adjacent	-70.04		
156.8	Lower adjacent	-70.73		
	Upper adjacent	-70.05		
157.425	Lower adjacent	-70.31		
	Upper adjacent	-70.07		

Low Power				
Test Frequency (MHz)	Test Channel	Measurement Power (dBc)	Limit (dB)	Result
156.05	Lower adjacent	-70.76	≤-70	Pass
	Upper adjacent	-70.16		
156.8	Lower adjacent	-70.10		
	Upper adjacent	-70.08		
157.425	Lower adjacent	-70.46		
	Upper adjacent	-70.35		

3.4.6 Result

The equipment met the requirement of this clause.

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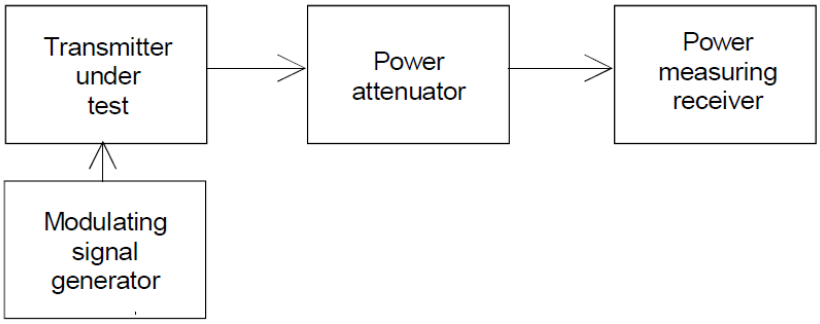
3.5 Unwanted emissions in the spurious domain-Conducted

Spurious emissions are emissions at frequencies other than those of the carrier and sidebands associated with normal modulation.

3.5.1 LIMIT

ETSI EN 300 025-1 Sub-clause 8.8
The power of any conducted spurious emission on any discrete frequency shall not exceed 0.25μW.

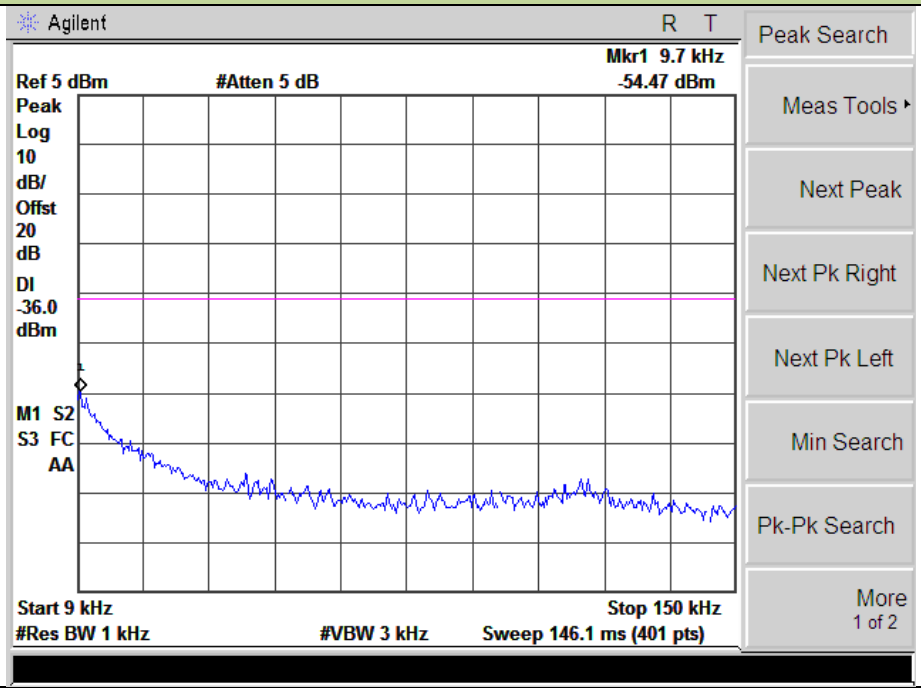
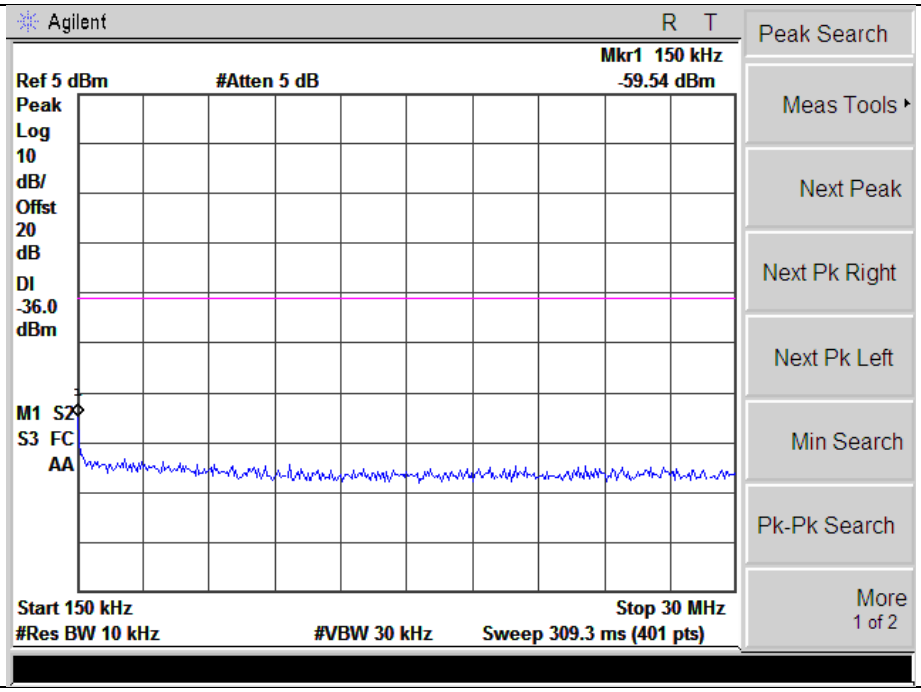
3.5.2 TEST CONFIGURATION



3.5.3 TEST PROCEDURE

Refer to ETSI EN 301 025-1 Sub-clause 8.8.2 Conducted spurious emissions shall be measured with the unmodulated transmitter connected to the artificial antenna (see clause 6.5).
The measurements shall be made over a range from 9 kHz to 2 GHz, excluding the channel on which the transmitter is operating and its adjacent channels.
The measurements for each spurious emission shall be made using a tuned radio measuring instrument or a spectrum analyser.

3.5.4 Test Result as follows:

Op 1 CH1

9KHz-150KHz

150KHz-30MHz

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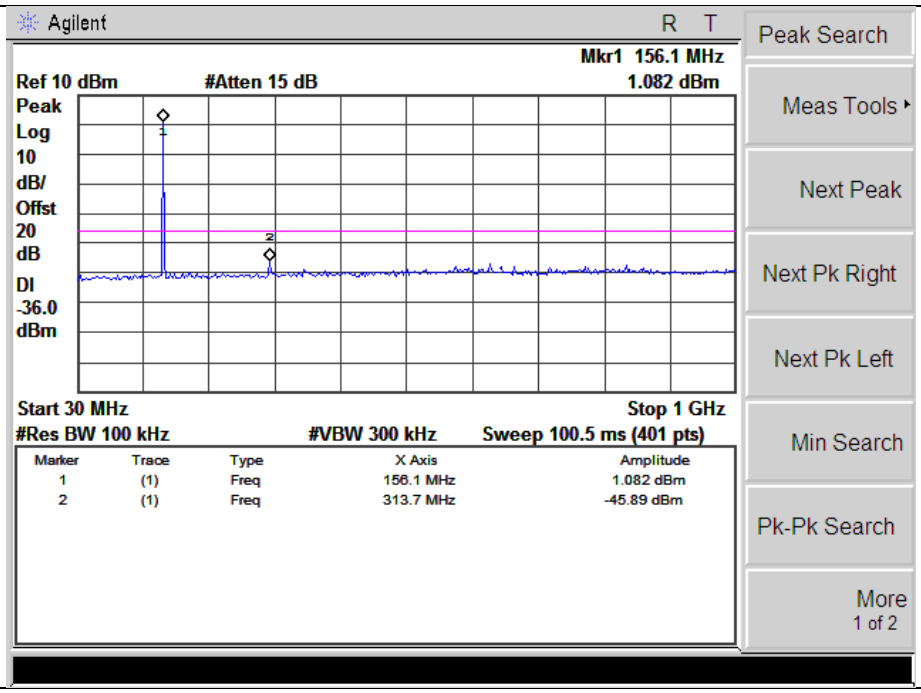
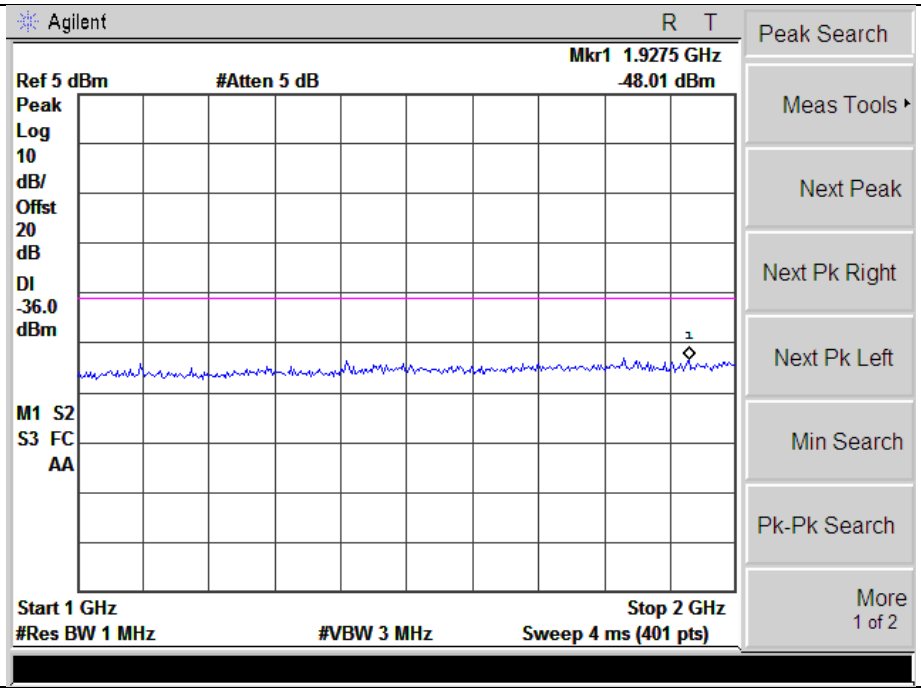


30MHz-1000MHz



1GHz-2. GHz

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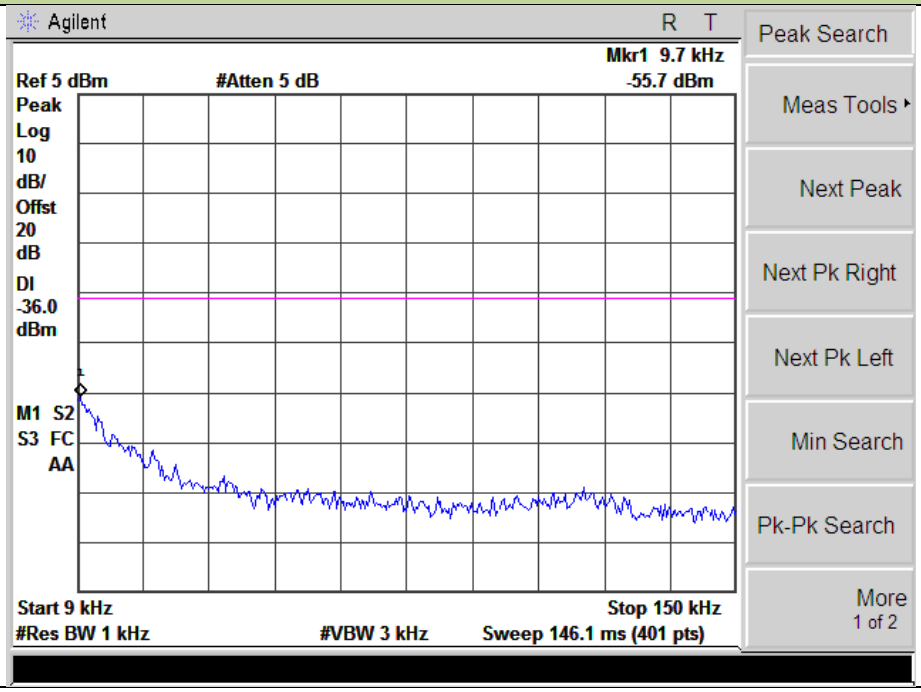
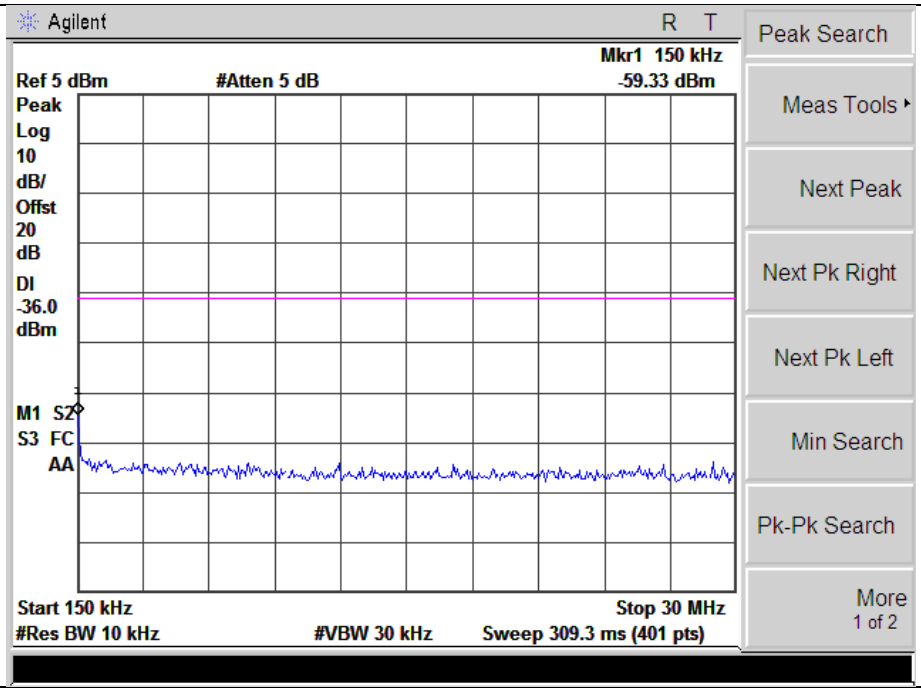
Op 1 CH16

9KHz-150KHz

150KHz-30MHz

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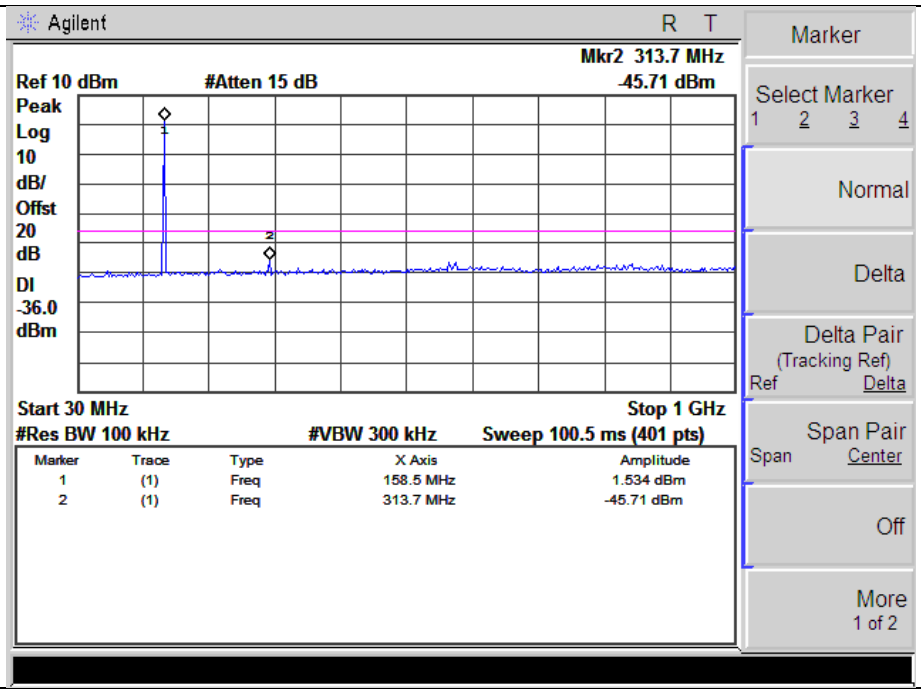
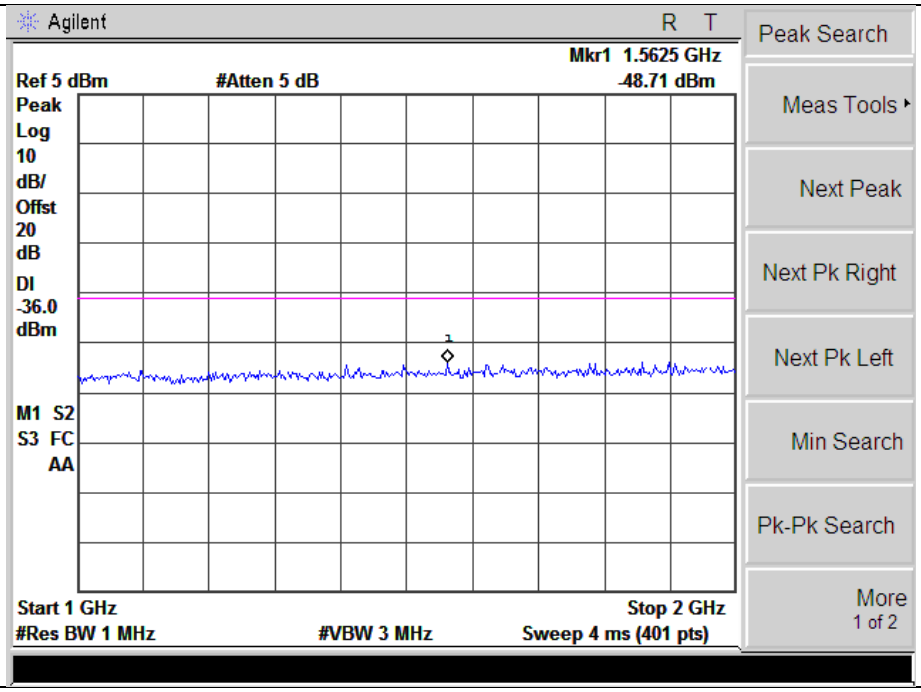


30MHz-1000MHz



1GHz-12.5GHz

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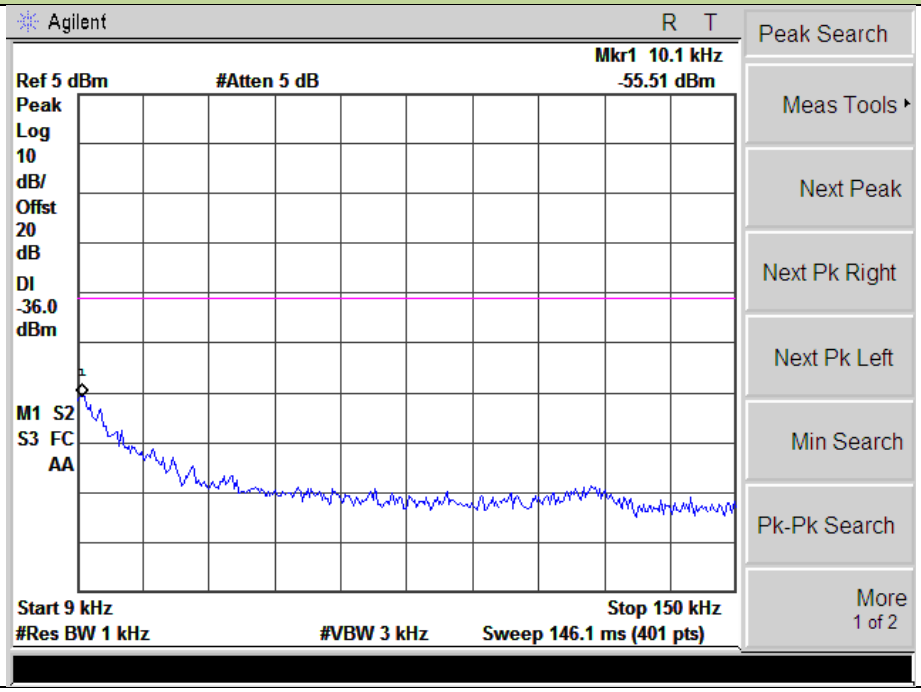
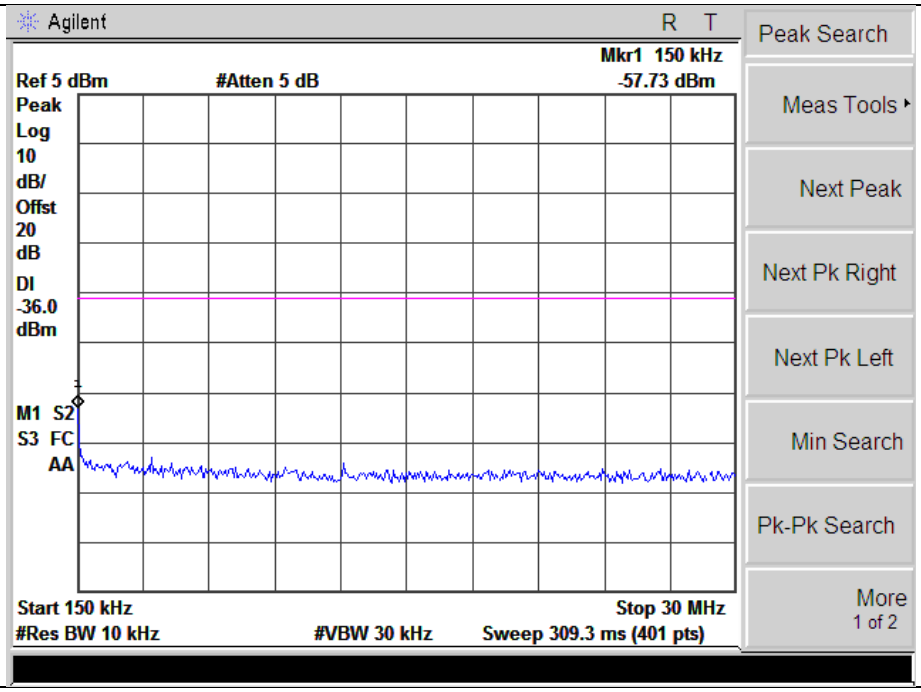
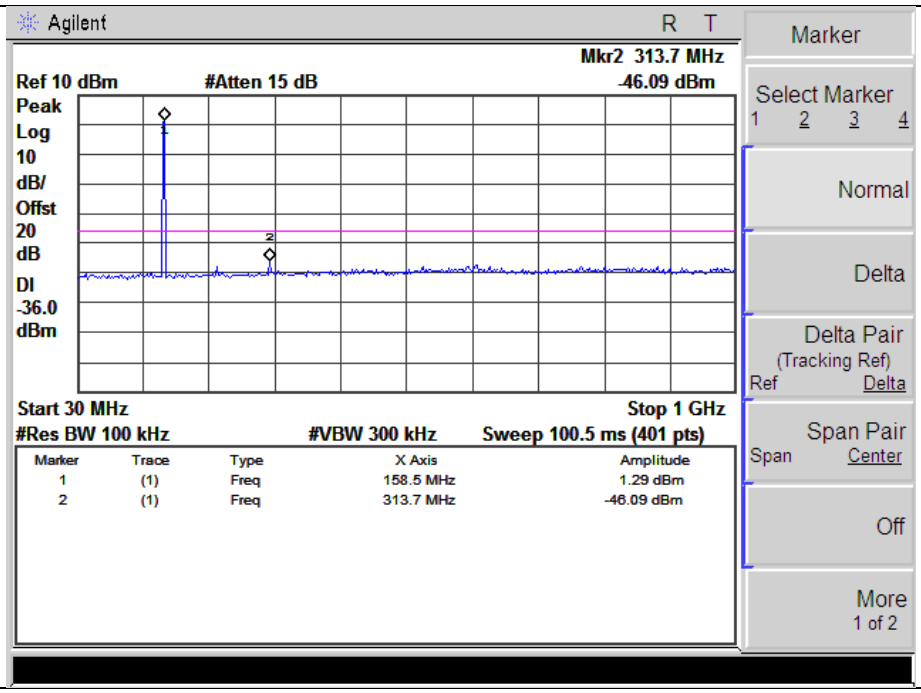
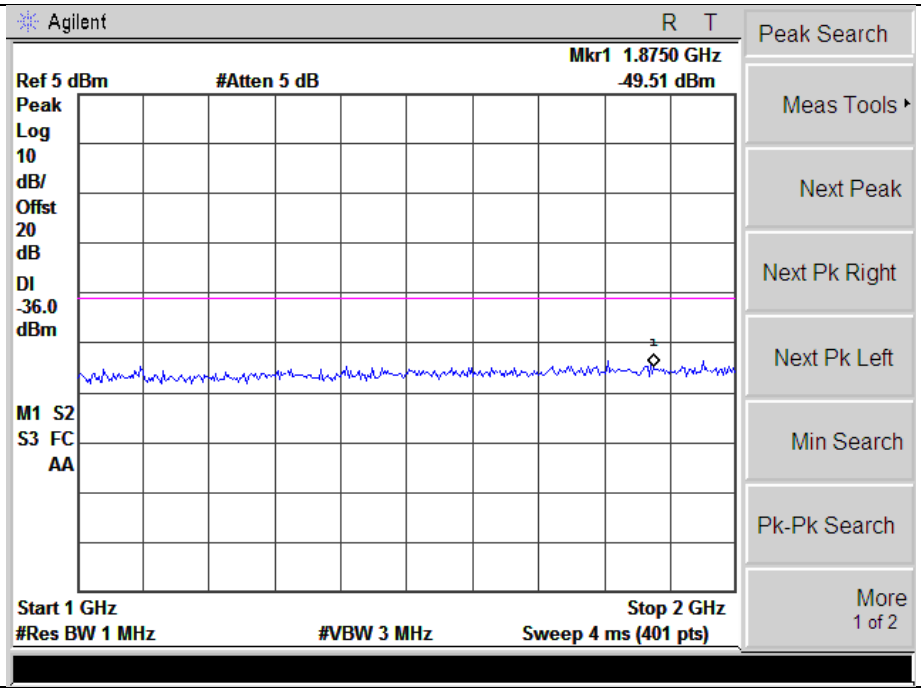
Op 1 CH70

9KHz-150KHz

150KHz-30MHz



30MHz-1000MHz



1GHz-2GHz

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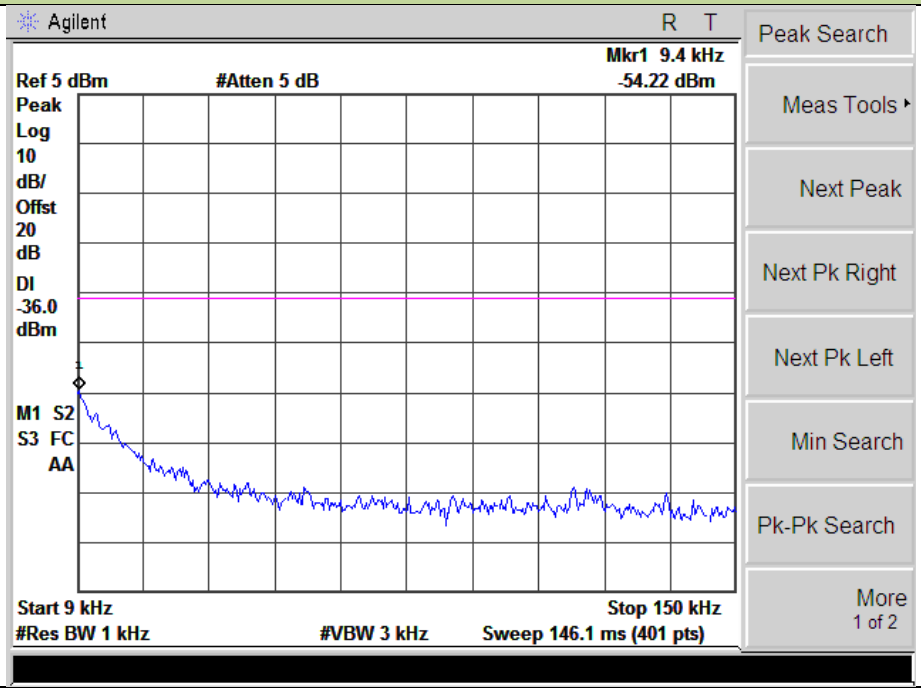
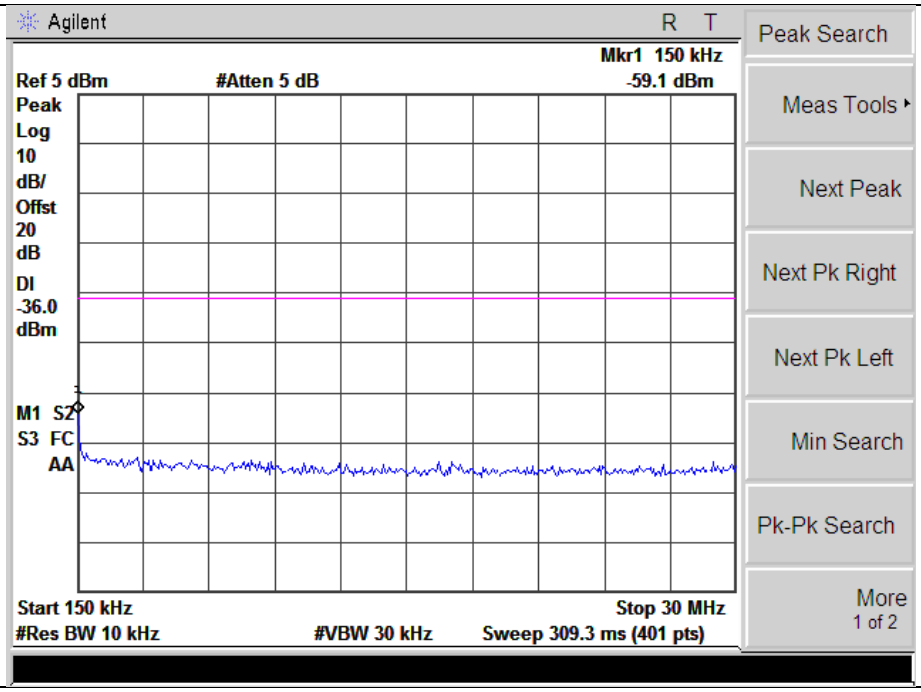
Op 1 CH88

9KHz-150KHz

150KHz-30MHz

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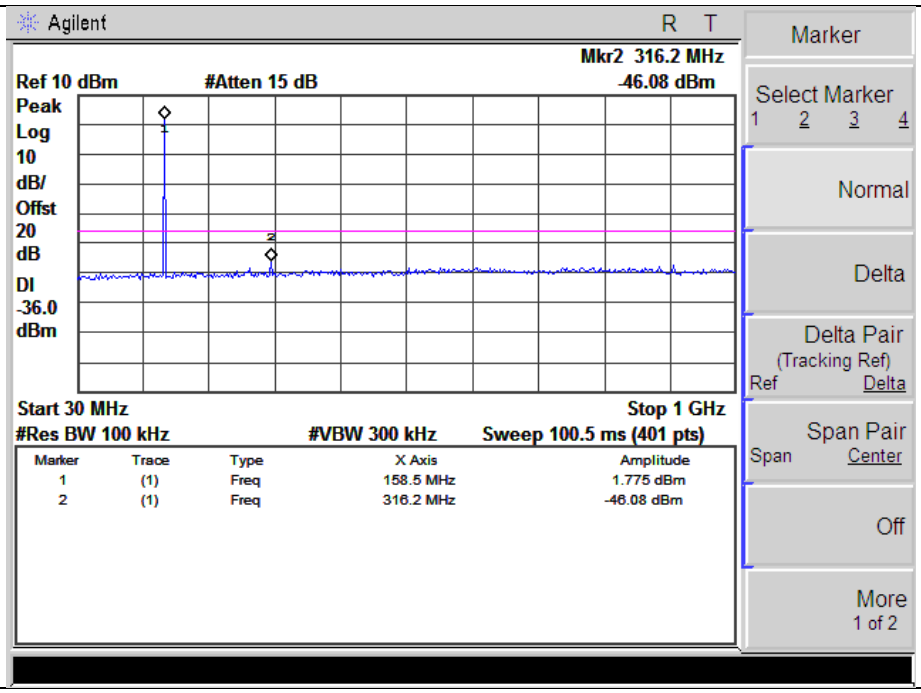
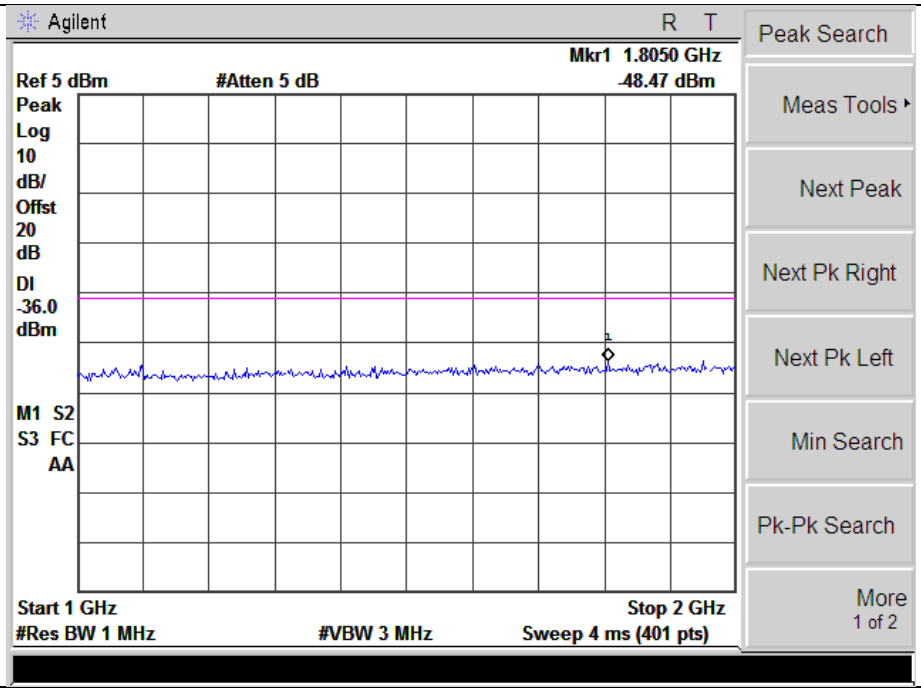


30MHz-1000MHz



1GHz-2GHz

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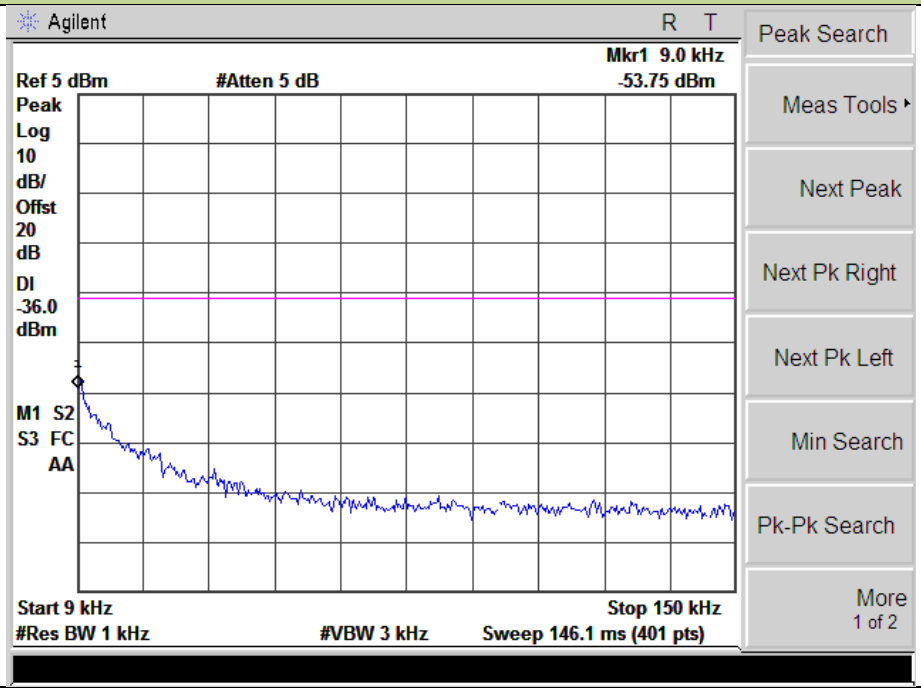
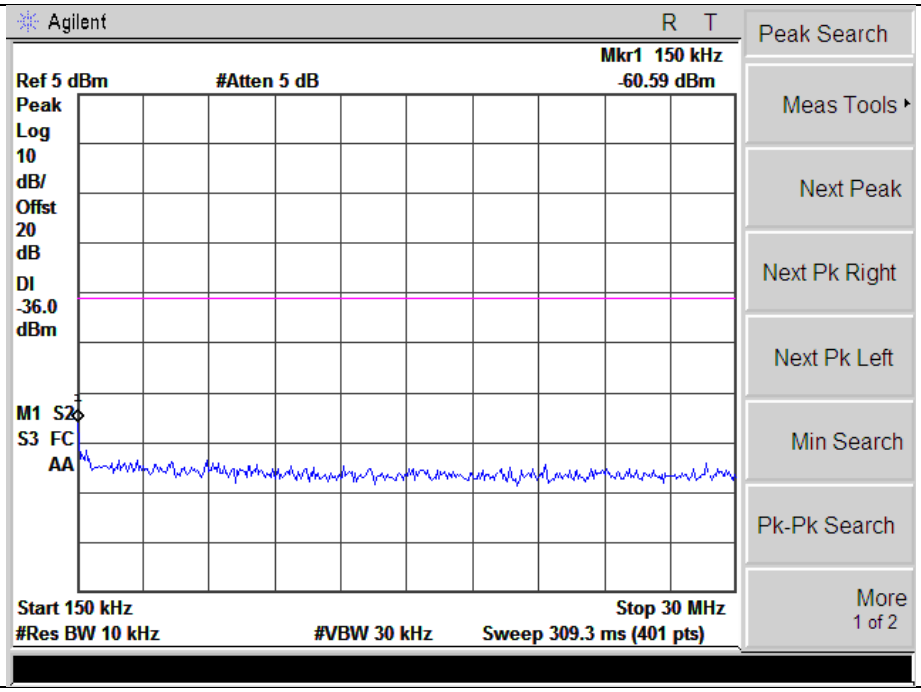
Op 2 CH1

9KHz-150KHz

150KHz-30MHz

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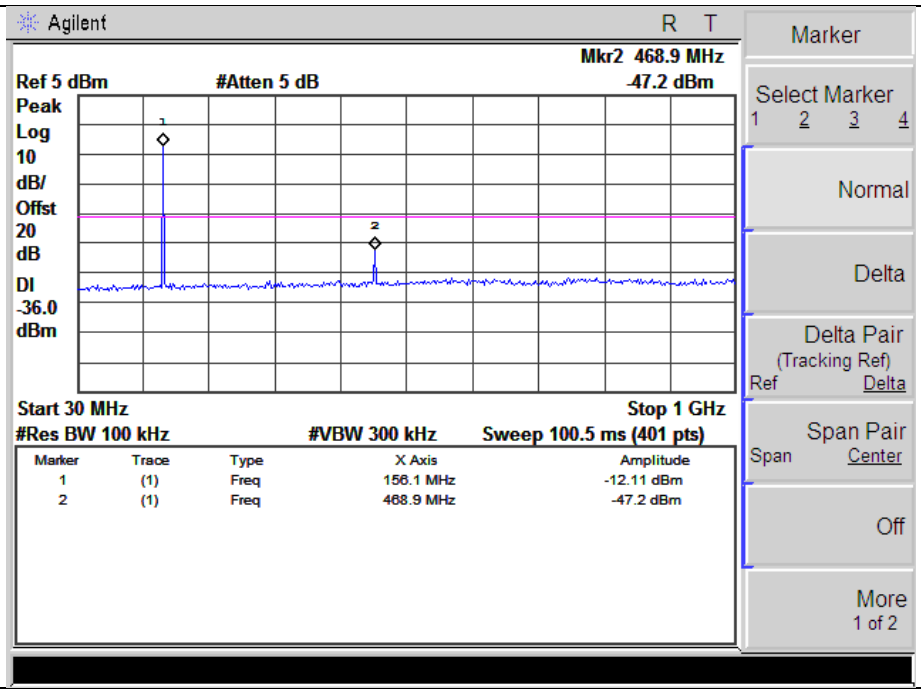
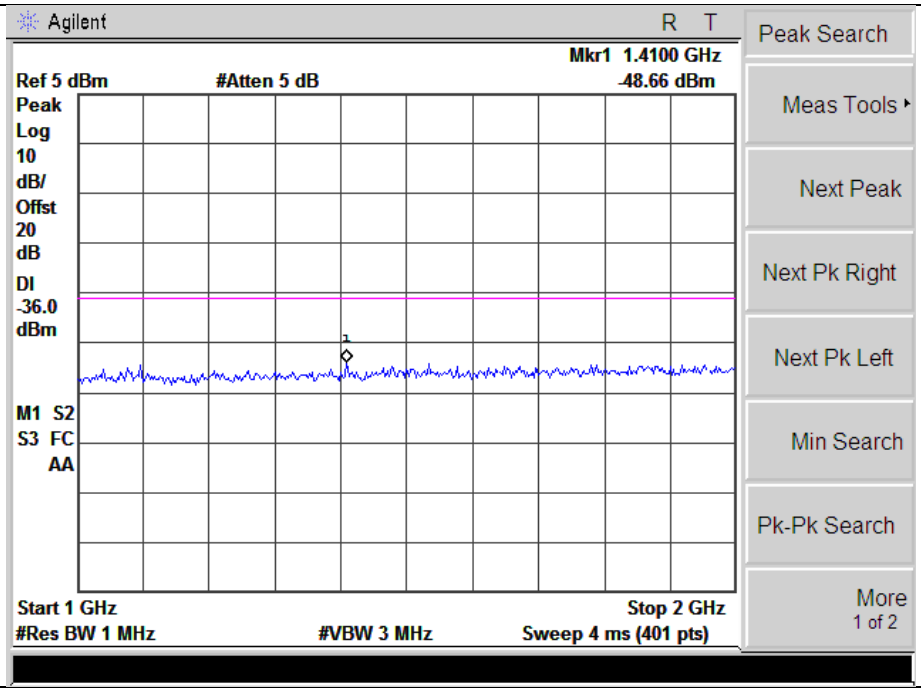


30MHz-1000MHz



1GHz-2GHz

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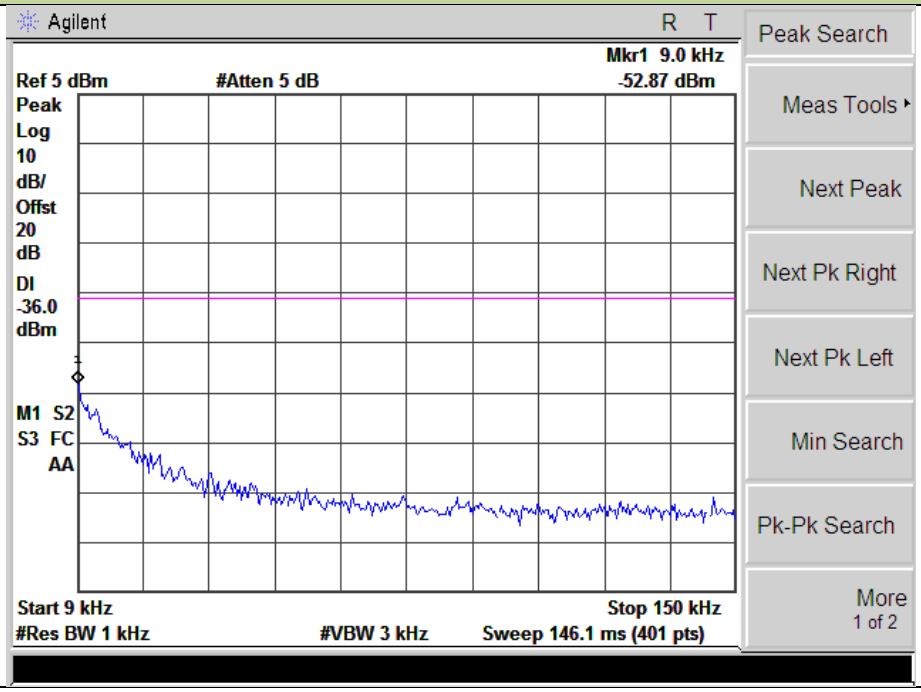
Op 2 CH16

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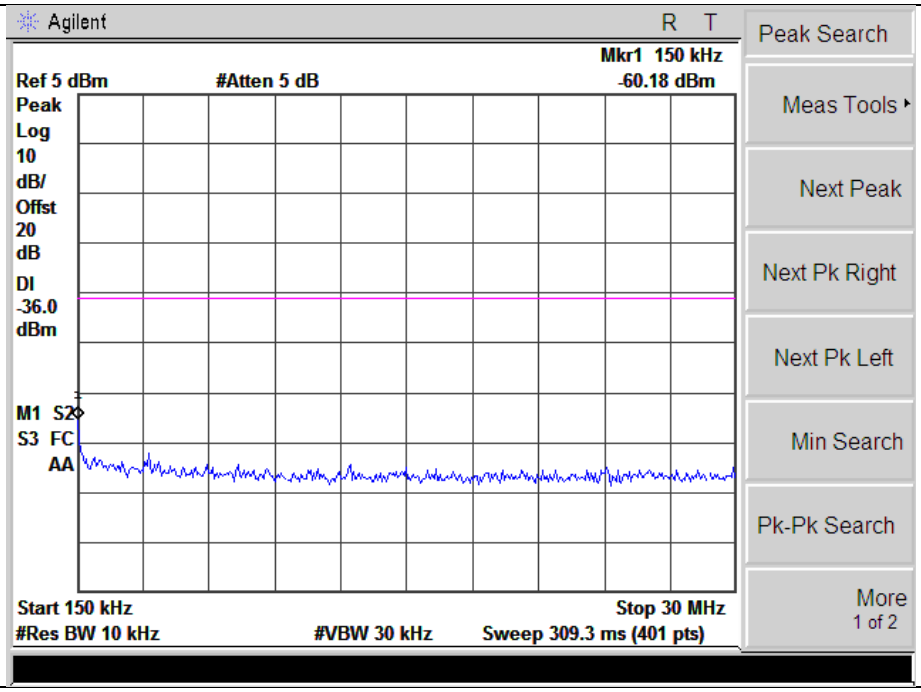
150KHz-30MHz

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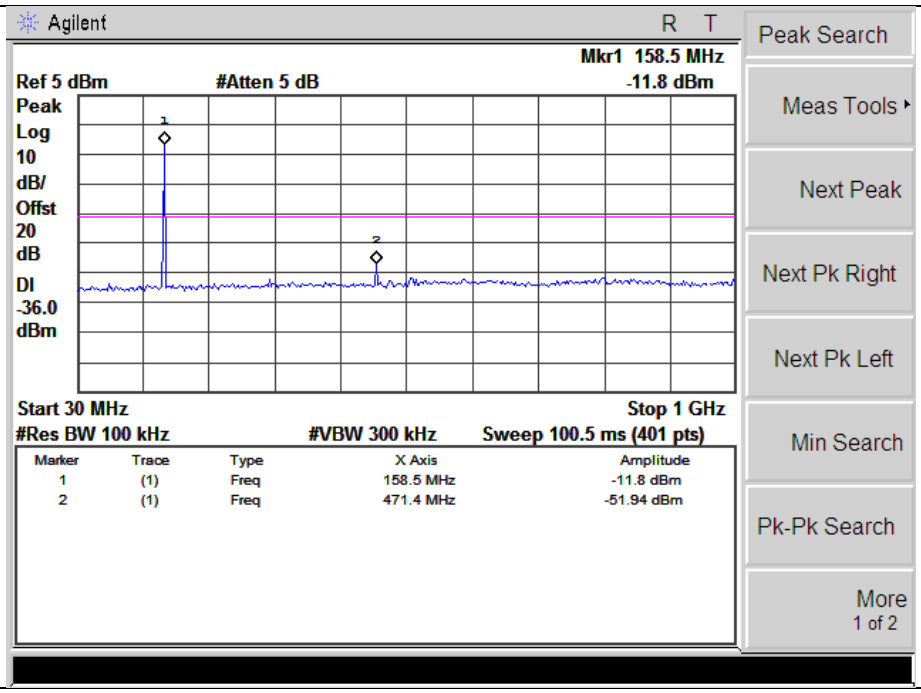
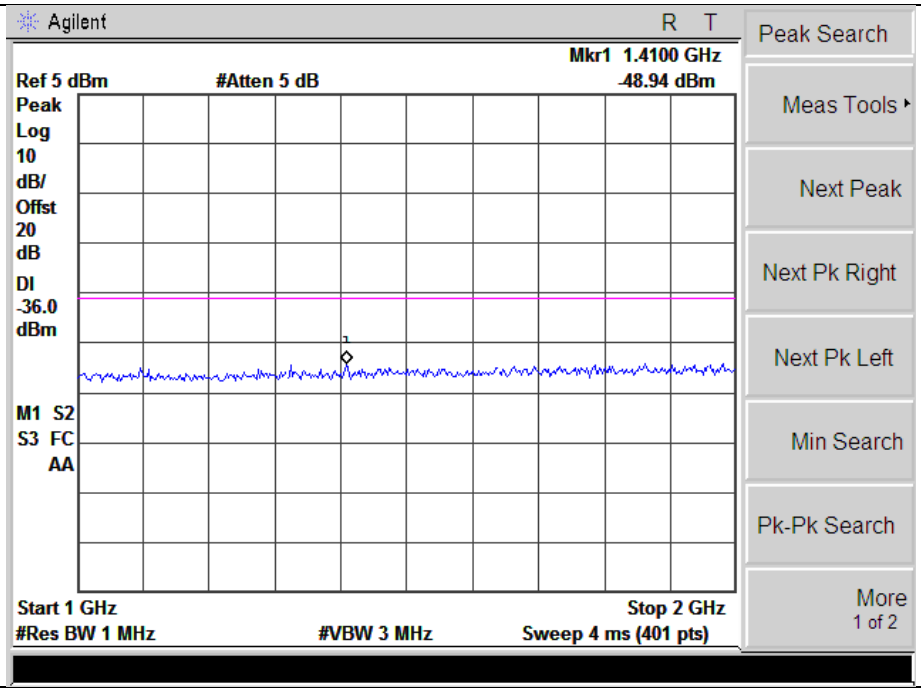


30MHz-1000MHz



1GHz-2GHz

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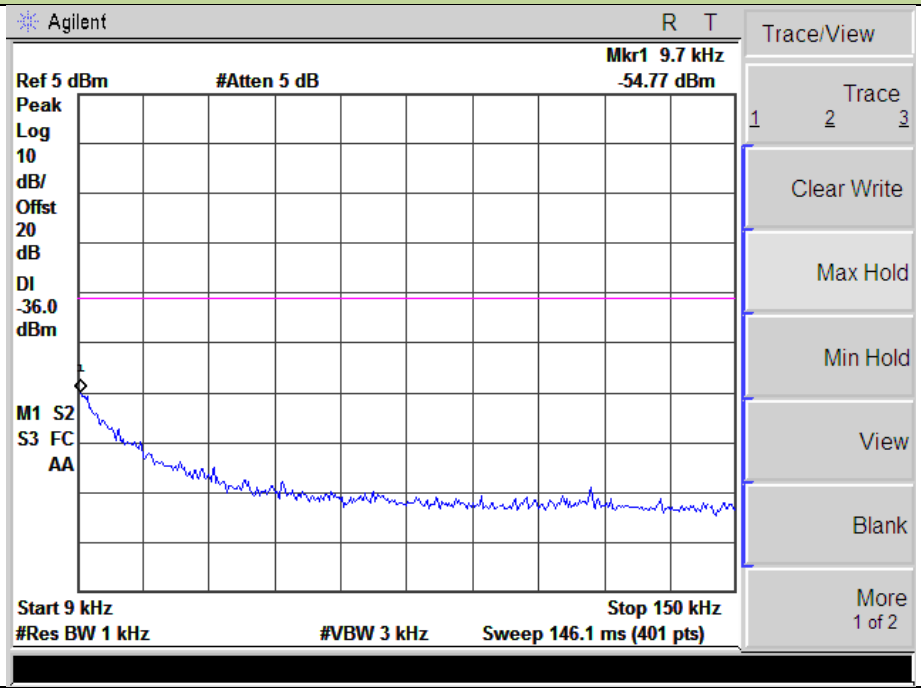
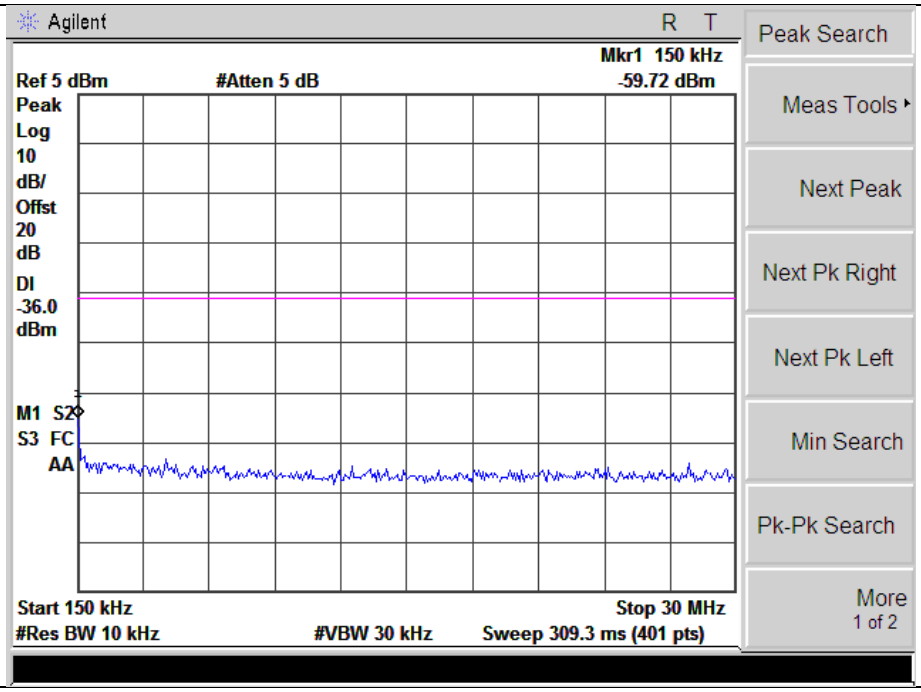
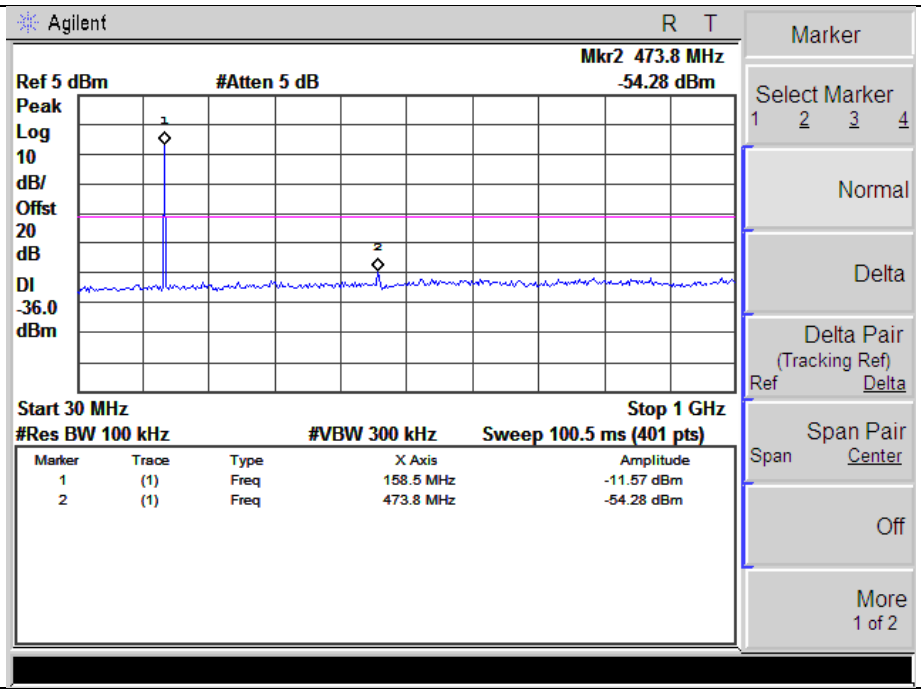
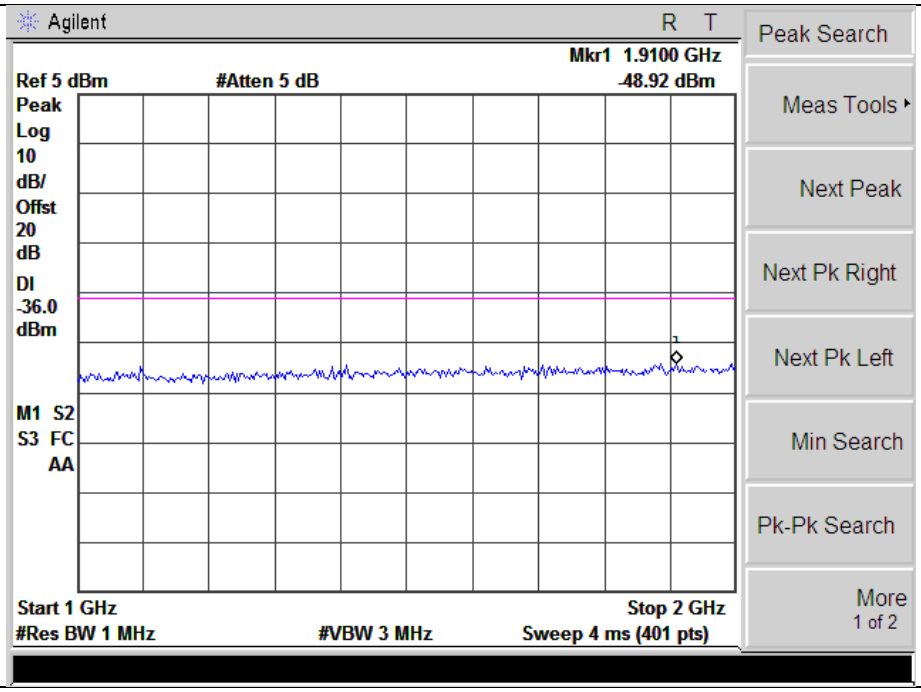
Op 2 CH88

9KHz-150KHz

150KHz-30MHz



30MHz-1000MHz



1GHz-2GHz

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3.6 Transmitter unwanted emissions in the spurious domain-Radiated

Spurious emissions are emissions at frequencies other than those of the carrier and sidebands associated with normal modulation.

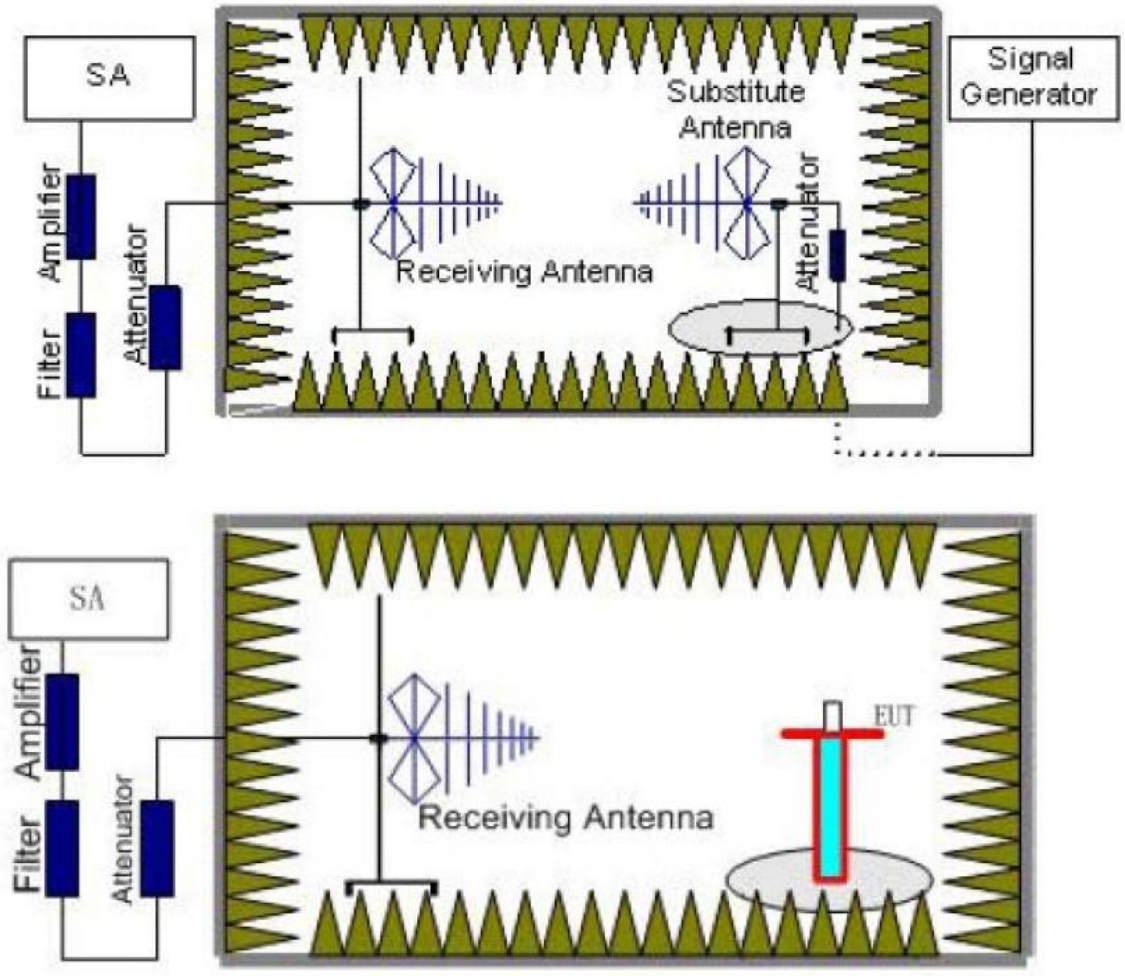
3.6.1 LIMIT

ETSI EN 300 025-1 Sub-clause 8.9.3

When the transmitter is in stand-by the cabinet radiation and spurious emissions shall not exceed 2 nW.

When the transmitter is in operation the cabinet radiation and spurious emissions shall not exceed 0,25 µW.

3.6.2 TEST CONFIGURATION



3.6.3 TEST PROCEDURE

Refer to ETSI EN 300 025-1 Sub-clause 8.9.2

On a test site, selected from annex B, the equipment shall be placed at the specified height on a non-conducting support and in position closest to normal use as declared by the manufacturer.

The transmitter antenna connector shall be connected to on artificial antenna, clause 6.5.

The test antenna shall be orientated for vertical polarization and the length of the test antenna shall be chosen to correspond to the instantaneous frequency of the measuring receiver.

The output of the test antenna shall be connected to a measuring receiver.

The transmitter shall be switched on without modulation, and measuring receiver shall be tuned over the frequency range 30 MHz to 2 GHz, except for the channel on which the transmitter is intended to operate and its adjacent channels.

At each frequency at which a spurious component is detected:
a) the test antenna shall be raised and lowered through the specified range of heights until a maximum signal level is detected on the measuring receiver;
b) the transmitter shall be rotated through 360° in the horizontal plane, until the maximum signal level is detected by the measuring receiver;
c) the maximum signal level detected by the measuring receiver shall be noted;
d) the transmitter shall be replaced by a substitution antenna as defined in annex B;
e) the substitution antenna shall be orientated for vertical polarization and the length of the substitution antenna shall be adjusted to correspond to the frequency of the spurious component detected;
f) the substitution antenna shall be connected to a calibrated signal generator;
g) the frequency of the calibrated signal generator shall be set to the frequency of the spurious component detected;
h) the input attenuator setting of the measuring receiver shall be adjusted in order to increase the sensitivity of the measuring receiver, if necessary;
i) the test antenna shall be raised and lowered through the specified range of heights to ensure that the maximum signal is received;
j) the input signal to the substitution antenna shall be adjusted to the level that produces a level detected by the measuring receiver that is equal to the level noted while the spurious component was measured, corrected for the change of input attenuator setting of the measuring receiver;
k) the input level to the substitution antenna shall be recorded as power level, corrected for the change of input attenuator setting of the measuring receiver;
l) the measurement shall be repeated with the test antenna and the substitution antenna orientated for horizontal polarization;
m) the measure of the effective radiated power of the spurious components is larger of the two power levels recorded for spurious component at the input to the substitution antenna, corrected for the gain of the antenna if necessary;
n) the measurements shall be repeated with the transmitter on stand-by.

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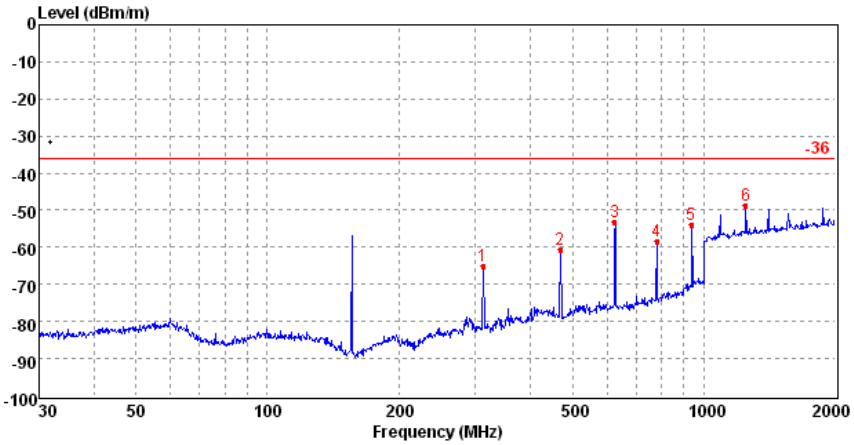
3.6.4 TEST RESULTS

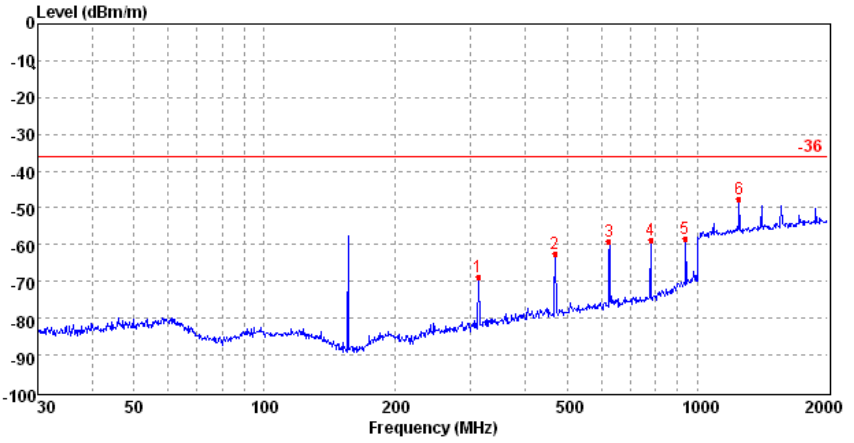
Remark: 1. We tested radiated spurious for Op 1(High Power Tx Mode) and Op 2(Low Power Tx Mode)
2. The spurious emission (standby mode) test results refer to 4.2.8 of this report.

Op 1			
Test Frequency:	156.05MHz	Polarity:	Horizontal



Mark	Frequency MHz	Reading dBm	Antenna dB	Cable dB	Preamp dB	Level dBm	Limit dBm	Over limit	Remark
1	312.06	-64.74	26.50	1.96	28.86	-65.14	-30.00	-35.14	Peak
2	469.24	-63.51	29.34	2.42	28.91	-60.66	-30.00	-30.66	Peak
3	626.07	-58.99	31.76	2.95	28.73	-53.01	-30.00	-23.01	Peak
4	781.33	-66.09	33.03	3.27	28.54	-58.33	-30.00	-28.33	Peak
5	938.10	-65.61	36.45	3.64	28.38	-53.90	-30.00	-23.90	Peak
6	1248.33	-64.07	39.26	4.24	28.23	-48.80	-36.00	-12.80	Peak

Test Frequency:	156.05MHz	Polarity:	Vertical



Mark	Frequency MHz	Reading dBm	Antenna dB	Cable dB	Preamp dB	Level dBm	Limit dBm	Over limit	Remark
1	312.06	-68.54	26.50	1.96	28.86	-68.94	-30.00	-38.94	Peak
2	469.24	-65.31	29.34	2.42	28.91	-62.46	-30.00	-32.46	Peak
3	626.07	-65.19	31.76	2.95	28.73	-59.21	-30.00	-29.21	Peak
4	781.33	-66.51	33.03	3.27	28.54	-58.75	-30.00	-28.75	Peak
5	938.10	-70.15	36.45	3.64	28.38	-58.44	-30.00	-28.44	Peak
6	1248.33	-63.00	39.26	4.24	28.23	-47.73	-36.00	-11.73	Peak

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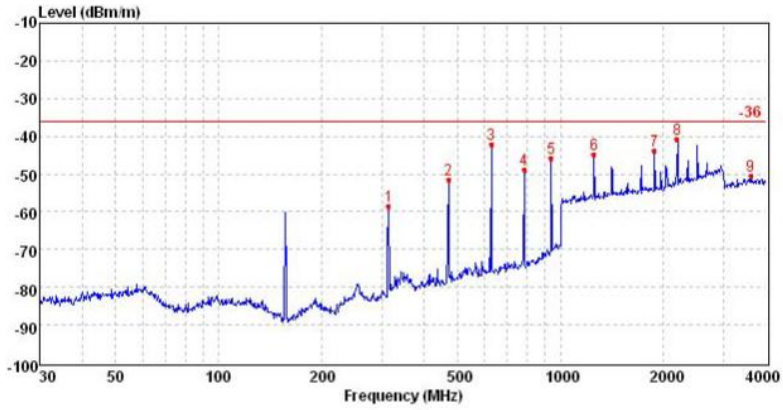
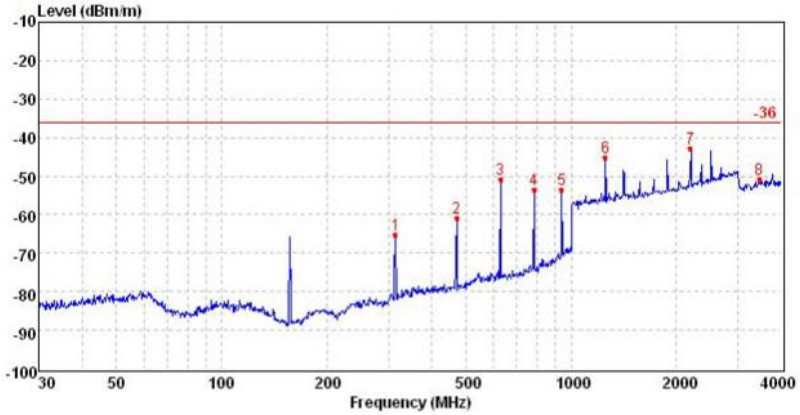
Op 1			
Test Frequency:	156.80MHz	Polarity:	Horizontal



Mark	Frequency MHz	Reading dBm	Antenna dB	Cable dB	Preamp dB	Level dBm	Limit dBm	Over limit	Remark
1	314.26	-58.09	26.55	1.97	28.86	-58.43	-36.00	-22.43	Peak
2	470.89	-54.42	29.34	2.42	28.91	-51.57	-36.00	-15.57	Peak
3	628.27	-48.19	31.76	2.95	28.72	-42.20	-36.00	-6.20	Peak
4	784.08	-56.49	33.09	3.27	28.53	-48.66	-36.00	-12.66	Peak
5	941.41	-57.58	36.64	3.64	28.37	-45.67	-36.00	-9.67	Peak
6	1253.97	-60.25	39.29	4.24	28.23	-44.95	-36.00	-8.95	Peak
7	1880.81	-61.85	40.84	5.38	28.06	-43.69	-36.00	-7.69	Peak
8	2195.93	-60.74	41.59	5.95	27.73	-40.93	-36.00	-4.93	Peak
9	3607.38	-65.40	44.00	8.75	37.99	-50.64	-36.00	-14.64	Peak

Test Frequency:	156.80MHz	Polarity:	Vertical



Mark	Frequency MHz	Reading dBm	Antenna dB	Cable dB	Preamp dB	Level dBm	Limit dBm	Over limit	Remark
1	314.26	-64.78	26.55	1.97	28.86	-65.12	-36.00	-29.12	Peak
2	470.89	-63.81	29.34	2.42	28.91	-60.96	-36.00	-24.96	Peak
3	628.27	-56.97	31.76	2.95	28.72	-50.98	-36.00	-14.98	Peak
4	784.08	-61.26	33.09	3.27	28.53	-53.43	-36.00	-17.43	Peak
5	941.41	-65.55	36.64	3.64	28.37	-53.64	-36.00	-17.64	Peak
6	1253.97	-60.31	39.29	4.24	28.23	-45.01	-36.00	-9.01	Peak
7	2195.93	-62.67	41.59	5.95	27.73	-42.86	-36.00	-6.86	Peak
8	3449.28	-65.46	43.73	8.75	37.99	-50.97	-36.00	-14.97	Peak

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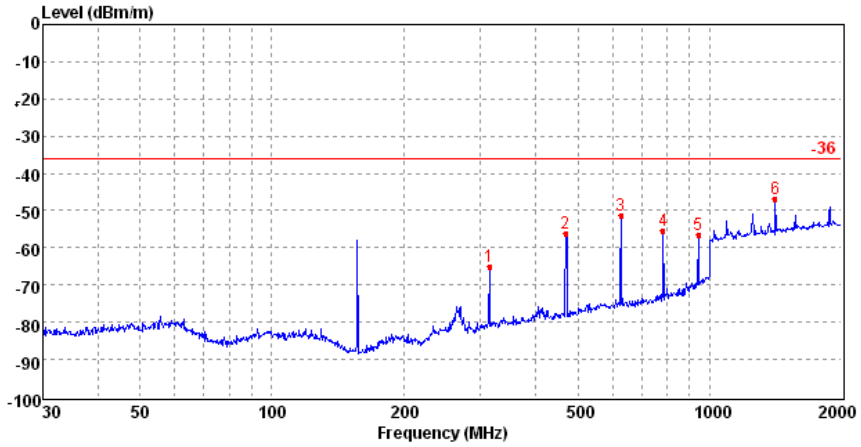
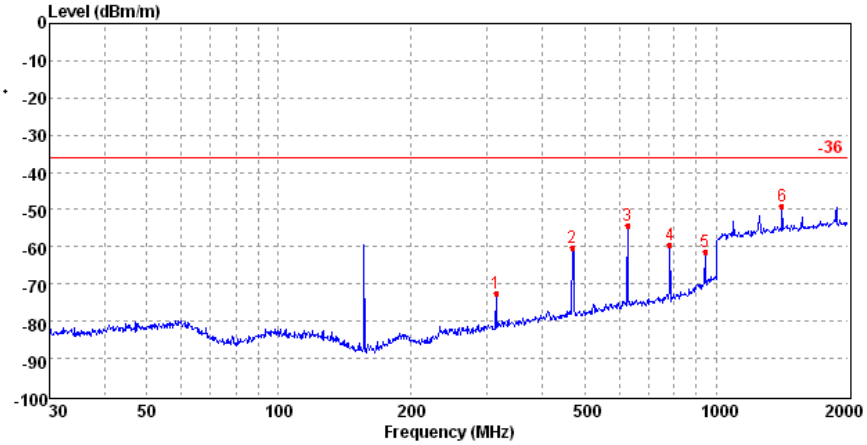
Op 1			
Test Frequency:	156.525MHz	Polarity:	Horizontal



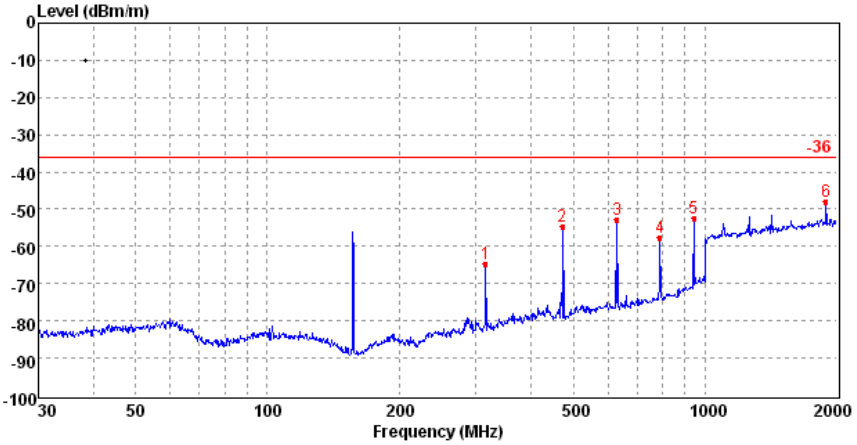
Mark	Frequency MHz	Reading dBm	Antenna dB	Cable dB	Preamp dB	Level dBm	Limit dBm	Over limit	Remark
1	313.82	-64.87	26.55	1.96	28.86	-65.22	-36.00	-29.22	Peak
2	469.66	-59.16	29.34	2.42	28.91	-56.31	-36.00	-20.31	Peak
3	627.53	-57.19	31.76	2.95	28.72	-51.20	-36.00	-15.20	Peak
4	783.97	-63.16	33.09	3.27	28.53	-55.33	-36.00	-19.33	Peak
5	943.08	-68.26	36.64	3.64	28.37	-56.35	-36.00	-20.35	Peak
6	1411.39	-63.19	39.79	4.57	28.18	-47.01	-36.00	-11.01	Peak

Test Frequency:	156.525MHz	Polarity:	Vertical



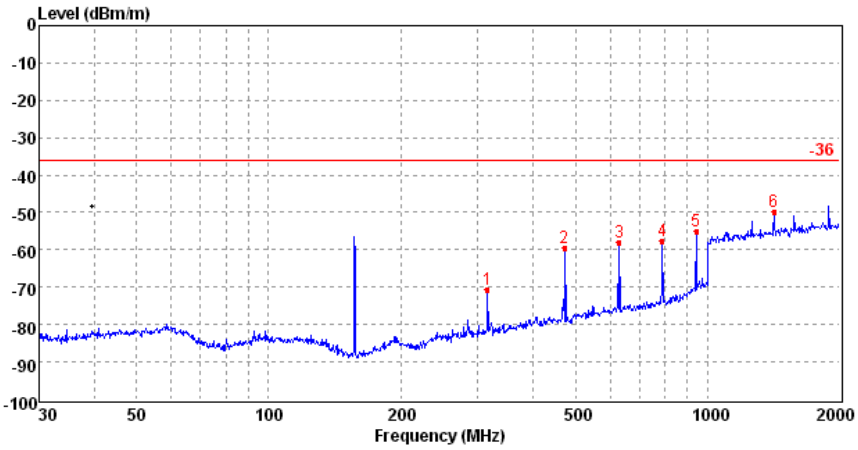
Mark	Frequency MHz	Reading dBm	Antenna dB	Cable dB	Preamp dB	Level dBm	Limit dBm	Over limit	Remark
1	313.82	-72.03	26.55	1.96	28.86	-72.38	-36.00	-36.38	Peak
2	469.66	-63.08	29.34	2.42	28.91	-60.23	-36.00	-24.23	Peak
3	627.53	-60.45	31.76	2.95	28.72	-54.46	-36.00	-18.46	Peak
4	783.97	-67.39	33.09	3.27	28.53	-59.56	-36.00	-23.56	Peak
5	943.08	-73.22	36.64	3.64	28.37	-61.31	-36.00	-25.31	Peak
6	1411.39	-65.35	39.79	4.57	28.18	-49.17	-36.00	-13.17	Peak

Op 1			
Test Frequency:	157.425MHz	Polarity:	Horizontal



Mark	Frequency MHz	Reading dBm	Antenna dB	Cable dB	Preamp dB	Level dBm	Limit dBm	Over limit	Remark
1	315.37	-64.27	26.55	1.97	28.86	-64.61	-36.00	-28.61	Peak
2	472.55	-57.37	29.39	2.43	28.91	-54.46	-36.00	-18.46	Peak
3	630.49	-58.78	31.78	2.95	28.72	-52.77	-36.00	-16.77	Peak
4	789.62	-65.60	33.15	3.28	28.53	-57.70	-36.00	-21.70	Peak
5	944.72	-64.45	36.64	3.64	28.37	-52.54	-36.00	-16.54	Peak
6	1889.49	-66.35	40.84	5.42	28.05	-48.14	-36.00	-12.14	Peak

Test Frequency:	157.425MHz	Polarity:	Vertical



Mark	Frequency MHz	Reading dBm	Antenna dB	Cable dB	Preamp dB	Level dBm	Limit dBm	Over limit	Remark
1	315.37	-70.34	26.55	1.97	28.86	-70.68	-36.00	-34.68	Peak
2	472.55	-62.55	29.39	2.43	28.91	-59.64	-36.00	-23.64	Peak
3	630.49	-64.06	31.78	2.95	28.72	-58.05	-36.00	-22.05	Peak
4	789.62	-65.39	33.15	3.28	28.53	-57.49	-36.00	-21.49	Peak
5	944.72	-67.09	36.64	3.64	28.37	-55.18	-36.00	-19.18	Peak
6	1417.16	-66.14	39.82	4.57	28.17	-49.92	-36.00	-13.92	Peak

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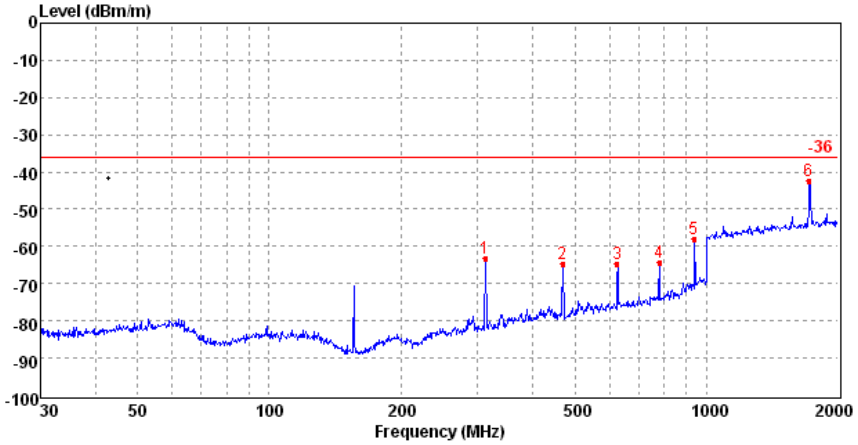
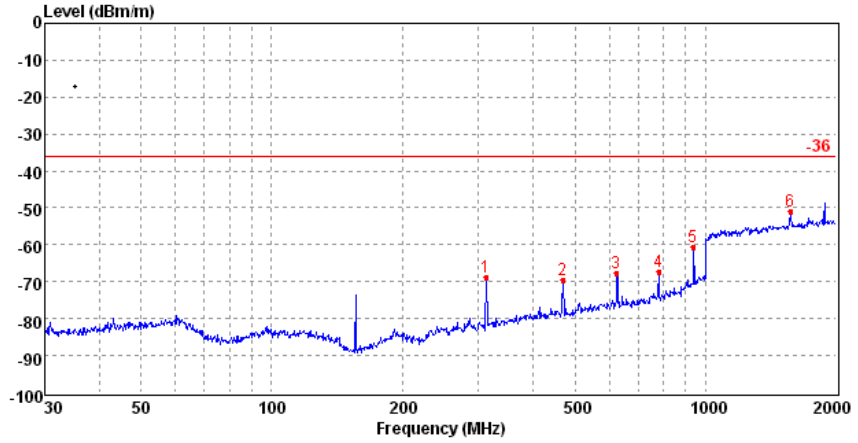
Op 2			
Test Frequency:	156.05MHz	Polarity:	Horizontal



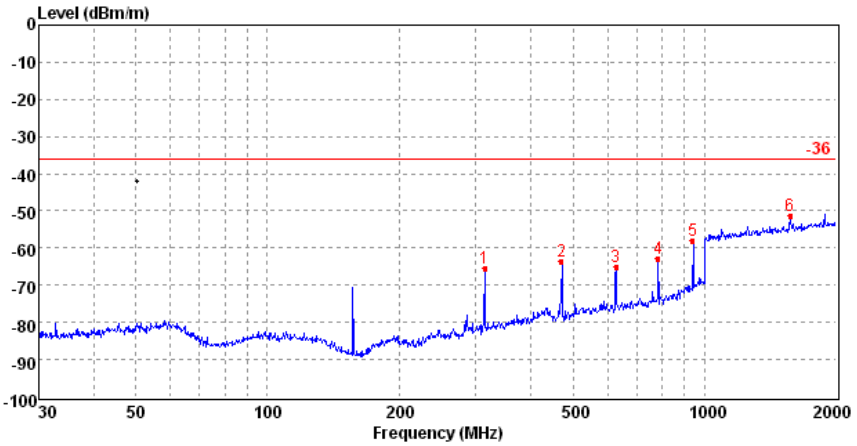
Mark	Frequency MHz	Reading dBm	Antenna dB	Cable dB	Preamp dB	Level dBm	Limit dBm	Over limit	Remark
1	312.06	-62.93	26.50	1.96	28.86	-63.33	-36.00	-27.33	Peak
2	469.24	-67.61	29.34	2.42	28.91	-64.76	-36.00	-28.76	Peak
3	626.07	-70.83	31.76	2.95	28.73	-64.85	-36.00	-28.85	Peak
4	781.33	-72.14	33.03	3.27	28.54	-64.38	-36.00	-28.38	Peak
5	938.10	-69.78	36.45	3.64	28.38	-58.07	-36.00	-22.07	Peak
6	1713.56	-59.97	40.52	5.12	28.09	-42.42	-36.00	-6.42	Peak

Test Frequency:	156.05MHz	Polarity:	Vertical



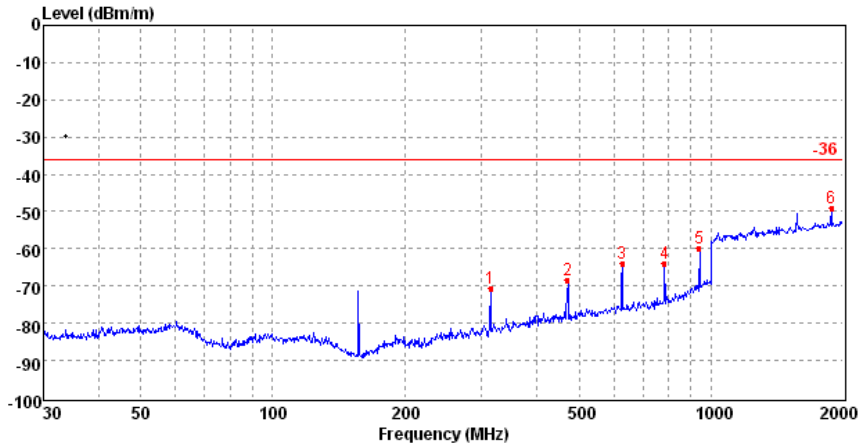
Mark	Frequency MHz	Reading dBm	Antenna dB	Cable dB	Preamp dB	Level dBm	Limit dBm	Over limit	Remark
1	312.06	-68.44	26.50	1.96	28.86	-68.84	-36.00	-32.84	Peak
2	469.24	-72.52	29.34	2.42	28.91	-69.67	-36.00	-33.67	Peak
3	623.87	-73.56	31.75	2.95	28.73	-67.59	-36.00	-31.59	Peak
4	781.33	-74.90	33.03	3.27	28.54	-67.14	-36.00	-31.14	Peak
5	938.10	-72.41	36.45	3.64	28.38	-60.70	-36.00	-24.70	Peak
6	1568.08	-67.85	40.20	4.86	28.13	-50.92	-36.00	-14.92	Peak

Op 2			
Test Frequency:	156.80MHz	Polarity:	Horizontal



Mark	Frequency MHz	Reading dBm	Antenna dB	Cable dB	Preamp dB	Level dBm	Limit dBm	Over limit	Remark
1	314.26	-65.02	26.55	1.97	28.86	-65.36	-36.00	-29.36	Peak
2	470.89	-66.57	29.34	2.42	28.91	-63.72	-36.00	-27.72	Peak
3	628.27	-71.11	31.76	2.95	28.72	-65.12	-36.00	-29.12	Peak
4	784.08	-70.77	33.09	3.27	28.53	-62.94	-36.00	-26.94	Peak
5	941.41	-69.78	36.64	3.64	28.37	-57.87	-36.00	-21.87	Peak
6	1568.08	-68.09	40.20	4.86	28.13	-51.16	-36.00	-15.16	Peak

Test Frequency:	156.80MHz	Polarity:	Vertical



Mark	Frequency MHz	Reading dBm	Antenna dB	Cable dB	Preamp dB	Level dBm	Limit dBm	Over limit	Remark
1	314.26	-70.36	26.55	1.97	28.86	-70.70	-36.00	-34.70	Peak
2	470.89	-71.19	29.34	2.42	28.91	-68.34	-36.00	-32.34	Peak
3	628.27	-70.11	31.76	2.95	28.72	-64.12	-36.00	-28.12	Peak
4	784.08	-71.74	33.09	3.27	28.53	-63.91	-36.00	-27.91	Peak
5	941.41	-71.94	36.64	3.64	28.37	-60.03	-36.00	-24.03	Peak
6	1882.96	-67.09	40.84	5.38	28.06	-48.93	-36.00	-12.93	Peak

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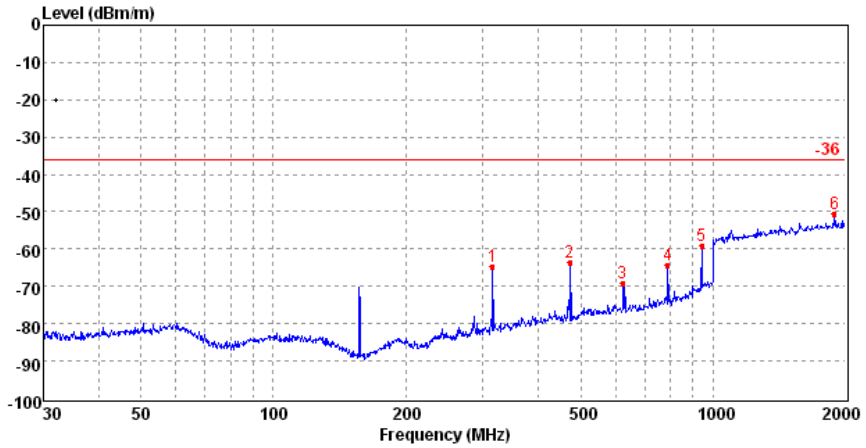
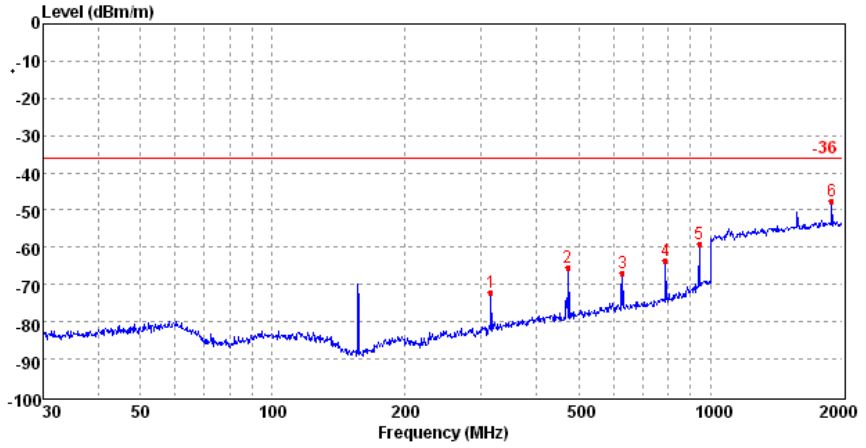
Op 2			
Test Frequency:	157.425MHz	Polarity:	Horizontal



Mark	Frequency MHz	Reading dBm	Antenna dB	Cable dB	Preamp dB	Level dBm	Limit dBm	Over limit	Remark
1	315.37	-64.21	26.55	1.97	28.86	-64.55	-36.00	-28.55	Peak
2	472.55	-66.35	29.39	2.43	28.91	-63.44	-36.00	-27.44	Peak
3	623.87	-75.00	31.75	2.95	28.73	-69.03	-36.00	-33.03	Peak
4	789.62	-72.25	33.15	3.28	28.53	-64.35	-36.00	-28.35	Peak
5	944.72	-71.02	36.64	3.64	28.37	-59.11	-36.00	-23.11	Peak
6	1889.49	-68.83	40.84	5.42	28.05	-50.62	-36.00	-14.62	Peak

Test Frequency:	157.425MHz	Polarity:	Vertical



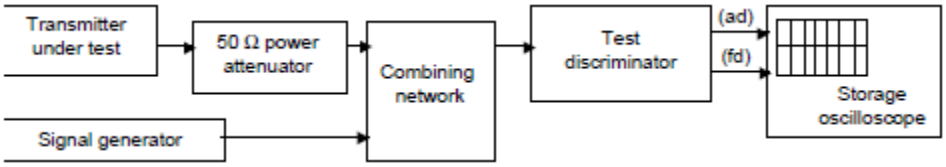
Mark	Frequency MHz	Reading dBm	Antenna dB	Cable dB	Preamp dB	Level dBm	Limit dBm	Over limit	Remark
1	315.37	-71.81	26.55	1.97	28.86	-72.15	-36.00	-36.15	Peak
2	472.55	-68.50	29.39	2.43	28.91	-65.59	-36.00	-29.59	Peak
3	630.49	-72.86	31.78	2.95	28.72	-66.85	-36.00	-30.85	Peak
4	789.62	-71.58	33.15	3.28	28.53	-63.68	-36.00	-27.68	Peak
5	944.72	-71.01	36.64	3.64	28.37	-59.10	-36.00	-23.10	Peak
6	1889.49	-65.63	40.84	5.42	28.05	-47.42	-36.00	-11.42	Peak

3.7 Transmitter Transient frequency behavior

3.7.1 Definition

The transient frequency behaviour of the transmitter is the variation in time of the transmitter frequency difference from the nominal frequency of the transmitter when the RF output power is switched on and off.
Table 2
t_1 (ms) 5,0
t_2 (ms) 20,0
t_3 (ms) 5,0
ton: the switch-on instant (ton) of a transmitter is defined by the condition when the output power, measured at the antenna terminal, exceeds 0,1 % of the nominal power;
t1: period of time starting at ton and finishing 5.0 ms later ;
t2: period of time starting at the end of t1 and finishing 20 ms latter ;
toff: switch-off instant defined by the condition when the nominal power falls below 0,1 % of the nominal power;
t3: period of time that finishing at toff and starting 5 ms earlier .

3.7.2 TEST CONFIGURATION



3.7.3 TEST PROCEDURE

ETSI EN 301 025-1Sub-clause 8.10.2 :
Two signals shall be connected to the test discriminator via a combining network.
The transmitter shall be connected to a 50 Ω power attenuator.
A test signal generator shall be connected to the second input of the combining network.
The test signal shall be adjusted to the nominal frequency of the transmitter.
The test signal shall be modulated by a frequency of 1 kHz with a deviation of ±25 kHz.
The test signal level shall be adjusted to correspond to 0,1 % of the power of the transmitter under test measured at the input of the test discriminator. This level shall be maintained throughout the measurement.
The amplitude difference (ad) and the frequency difference (fd) output of the test discriminator shall be connected to a storage oscilloscope.
The storage oscilloscope shall be set to display the channel corresponding to the (fd) input up to ±25 kHz.
The storage oscilloscope shall be set to a sweep rate of 10 ms/division and set so that the triggering occurs at one division from the left edge of the display.
The display shall show the 1 kHz test signal continuously.
The storage oscilloscope shall then be set to trigger on the channel corresponding to the amplitude difference (ad) input at a low input level, rising.
The transmitter shall then be switched on, without modulation, to produce the trigger pulse and a picture on the display.
The result of the change in the ratio of power between the test signal and the transmitter output will, due to the capture ratio of the test discriminator, produce two separate sides on the picture, one showing the 1 kHz test signal, the other the frequency difference of the transmitter versus time.
The moment when the 1 kHz test signal is completely suppressed is considered to provide ton.
The periods of time t1 and t2 as defined in table 2 shall be used to define the appropriate template.
The result shall be recorded as frequency difference versus time.
The transmitter shall remain switched on.
The storage oscilloscope shall be set to trigger on the channel corresponding to the amplitude difference (ad) input at a high input level, decaying and set so that the triggering occurs at 1 division from the right edge of the display.
The transmitter shall then be switched off.
The moment when the 1 kHz test signal starts to rise is considered to provide toff.
The period of time t3 as defined in table 2 shall be used to define the appropriate template.
The result shall be recorded as frequency difference versus time.

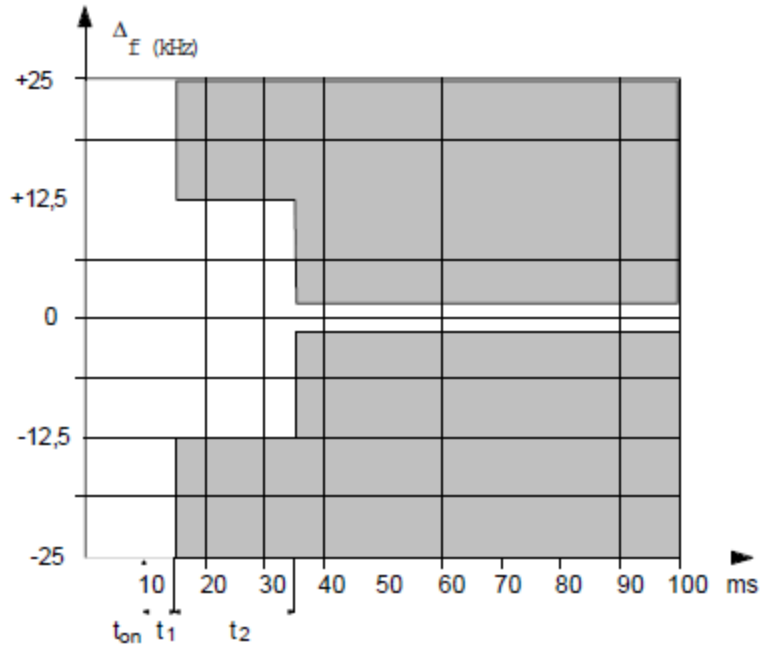
The carrier frequency shall be measured in the absence of modulation, with the transmitter connected to an artificial antenna non-reactive, non-radiating 50 Ω and tuned to channel 16.

Measurements shall be made under normal test conditions and under extreme test conditions.

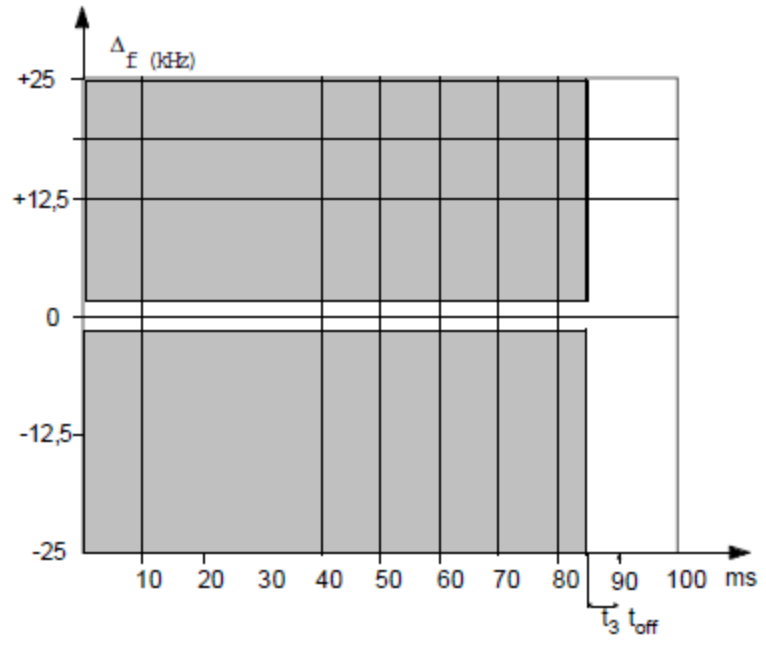
This test shall be carried out with the output power switch being set at both maximum and minimum.

3.7.4 LIMIT

Switch on condition:



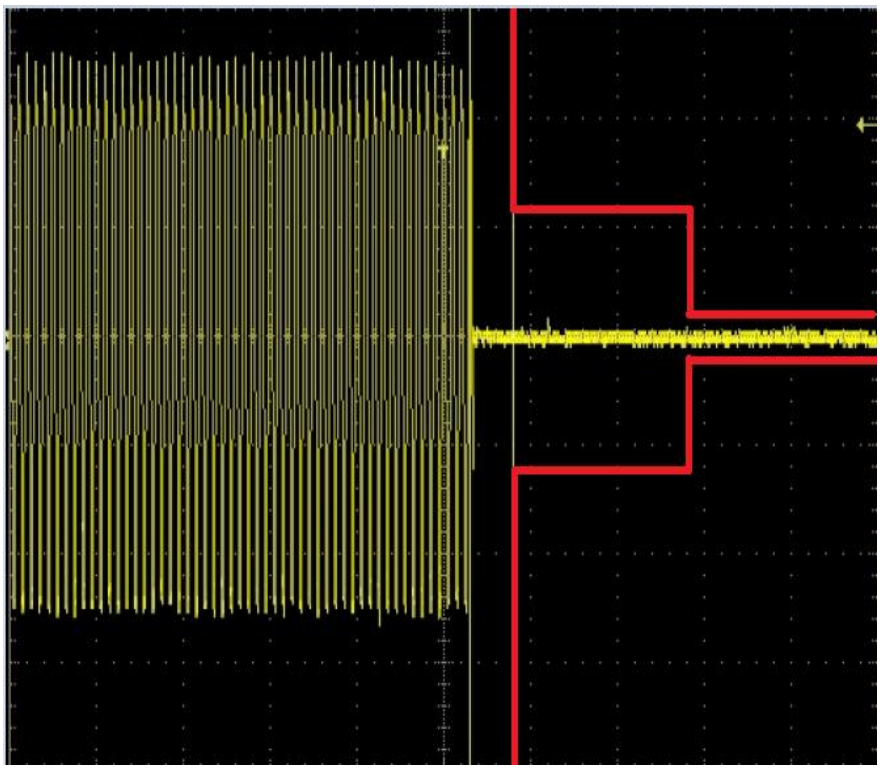
Switch off condition:



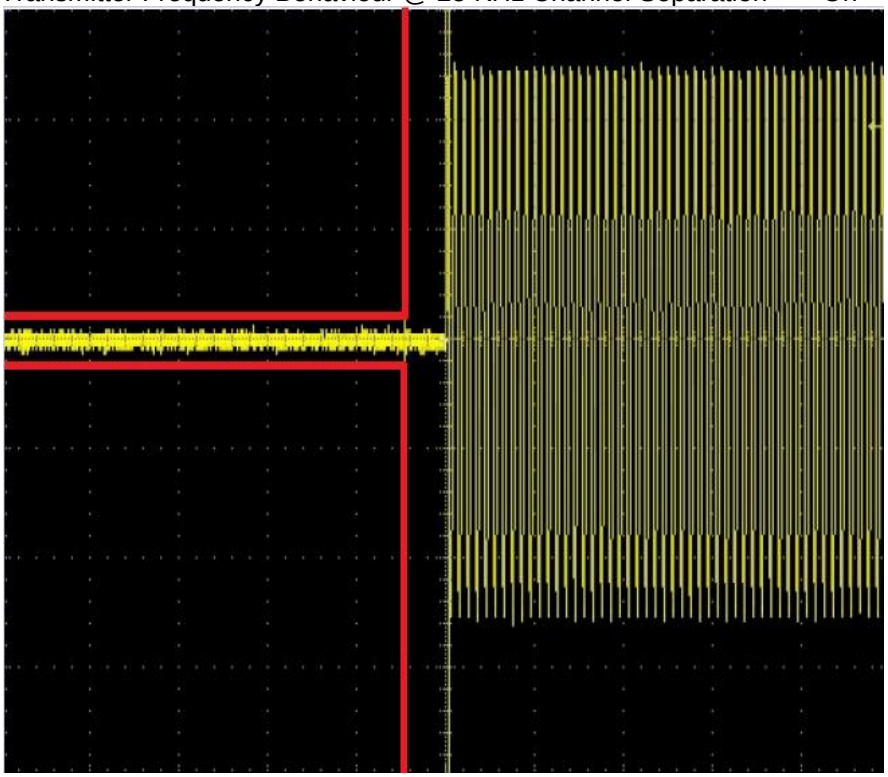
During the periods of time t1 and t3 the frequency difference shall not exceed ±25 kHz.
The frequency difference after the end of t2 shall be within the limit of ± 1.5 KHz
During the period of time t2 the frequency difference shall not exceed ±12,5 kHz.
Before the start of t3 the frequency difference shall be within the limit ± 1.5 K

3.7.5 Test result

Transmitter Frequency Behaviour @ 25 KHz Channel Separation------Off – On



Transmitter Frequency Behaviour @ 25 KHz Channel Separation------On – Off



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3.8 Transmitter DSC Frequency Error (demodulated DSC signal)

3.8.1 Definition

The frequency error for the B- and the Y-state is the difference between the measured frequency from the demodulator and the nominal values..

3.8.2 TEST CONFIGURATION / SIGNAL

Standard test signals for DSC = The standard test signal for a VHF DSC decoder shall be a phase-modulated signal at VHF channel 70 with modulation index = 2. The modulating signal shall have a nominal frequency of 1 700 Hz and a frequency shift of ±400 Hz with a modulation rate of 1 200 baud.
Standard test signals shall consist of a series of identical call sequences, each of which contain a known number of information symbols Standard test signals shall be of sufficient length for the measurements to be performed or it shall be possible to repeat them without interruption to make the measurements.

3.8.3 TEST PROCEDURE

ETSI EN 301 025-1Sub-clause 8.12.2 :

The transmitter shall be connected to the artificial antenna as specified in clause 6.5 and a suitable FM demodulator.
The transmitter shall be set to channel 70.
The transmitter shall be set to transmit a continuous B- or Y- state.
The measurement shall be performed by measuring the demodulated output, for both the continuous B- and Y-state.
The measurements shall be carried out under normal test conditions and extreme test conditions

3.8.4 LIMIT

The measured frequency from the demodulator at any time for the B-state shall be within 2 100 Hz ± 10 Hz and for the Y-state within 1 300 Hz ± 10 Hz.

3.8.5 Test result

Operation Mode	Test Conditions		Frequency Error (KHz)	Limit (KHz)	Result
	Temperature (℃)	Voltage(V)	157.425 (MHz)		
B- state	25	13.8	2105	2100 ± 10	Pass
	-15	17.94	2107		
		12.42	2108		
	55	17.94	2106		
		12.42	2107		
Y- state	25	13.8	1306	1300 ± 10	Pass
	-15	17.94	1304		
		12.42	1305		
	55	17.94	1307		
		12.42	1304		

3.8.6 Result

The equipment met the requirement of this clause.

3.9 Transmitter DSC Modulation Index

3.9.1 Definition

This test measures the modulation index in the B and Y states...

3.9.2 TEST CONFIGURATION / SIGNAL

Standard test signals for DSC = The standard test signal for a VHF DSC decoder shall be a phase-modulated signal at VHF channel 70 with modulation index = 2. The modulating signal shall have a nominal frequency of 1 700 Hz and a frequency shift of ±400 Hz with a modulation rate of 1 200 baud.
Standard test signals shall consist of a series of identical call sequences, each of which contain a known number of information symbols Standard test signals shall be of sufficient length for the measurements to be performed or it shall be possible to repeat them without interruption to make the measurements.

3.9.3 TEST PROCEDURE

ETSI EN 301 025-1Sub-clause 8.13.2 :
Transmitter shall be set to transmit continuous B and then Y signals. The frequency deviations shall be measured.

3.9.4 LIMIT

The modulation index shall be 2,0 ± 10 %..

3.9.5 Test result

Operation Mode	Test Frequency (MHz)	Modulation index	Limit	Result
B- state	156.525	2.01	2.0 ± 10 %	Pass
Y- state	156.525	2.05	2.0 ± 10 %	Pass

3.9.6 Result

The equipment met the requirement of this clause.

3.10 Transmitter DSC Modulation Rate

3.10.1 Definition

The modulation rate is the bit stream speed measured in bit/s....

3.10.2 TEST CONFIGURATION / SIGNAL

Standard test signals for DSC = The standard test signal for a VHF DSC decoder shall be a phase-modulated signal at VHF channel 70 with modulation index = 2. The modulating signal shall have a nominal frequency of 1 700 Hz and a frequency shift of ±400 Hz with a modulation rate of 1 200 baud.
Standard test signals shall consist of a series of identical call sequences, each of which contain a known number of information symbols Standard test signals shall be of sufficient length for the measurements to be performed or it shall be possible to repeat them without interruption to make the measurements.

3.10.3 TEST PROCEDURE

ETSI EN 301 025-1Sub-clause 8.14.2 :

The transmitter shall be set to transmit continuous dot pattern.
The RF output terminal of the transmitter, suitably attenuated, shall be connected via a linear FM demodulator to a calibrated FSK demodulator. The output of the FSK demodulator shall be limited in bandwidth by a low pass filter with a cut-off frequency of 1 kHz and a slope of 12 dB/octave.
The frequency of the output shall be measured.

3.10.4 LIMIT

The frequency shall be 600 Hz ± 30 ppm corresponding to a modulation rate of 1 200 baud.

3.10.5 Test result

Frequency deviation for a 1200 baud DSC signal = **599.999**

3.10.6 Result

The equipment met the requirement of this clause.

4 ETSI EN 301 025-2 Receiver Requirements

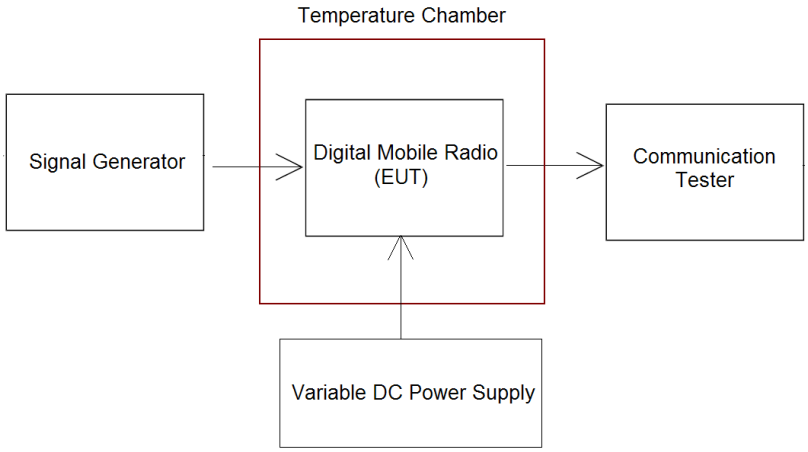
4.1 Receiver maximum useable sensitivity

4.1.1 Definition

The maximum usable sensitivity of the receiver is the minimum level of the signal (e.m.f.) at the nominal frequency of the receiver which, when applied to the receiver input with normal test modulation (see clause 6.4), will produce:

- in all cases, an audio frequency output power equal to 50 % of the rated output power (see clause 9.1); and
- a Signal + Noise + Distortion to Noise + Distortion (SINAD) ratio of 20 dB, measured at the receiver output through a psophometric telephone filtering network such as described in Recommendation ITU-T O.41 [i.6].

4.1.2 TEST CONFIGURATION / SIGNAL



4.1.3 TEST PROCEDURE

ETSI EN 301 025-1Sub-clause 9.3.2 :

A test signal at a carrier frequency equal to the nominal frequency of the receiver, modulated by the normal test modulation (see clause 6.4) shall be applied to the receiver input. An audio frequency load and a measuring instrument for measuring SINAD ratio (through a psophometric network) shall be connected to the receiver output terminals.

The level of the test signal shall be adjusted until a SINAD ratio of 20 dB is obtained, using the psophometric network and with the receiver's audio-frequency power control adjusted to produce 50 % of the rated output power. Under these conditions, the level of the test signal at the input is the value of the maximum usable sensitivity.

The measurements shall be made under normal test conditions (see clause 6.13) and under extreme test conditions (see clauses 6.14.1 and 6.14.2 applied simultaneously).

A receiver output power variation of ±3 dB relative to 50 % of the rated output power may be allowed for sensitivity measurements under extreme test conditions.

4.1.4 LIMIT

The maximum usable sensitivity for either 25 kHz or 12,5 kHz channels shall not exceed +6 dBµV (e.m.f.) under normal test conditions and +12 dBµV (e.m.f.) under extreme test conditions.

4.1.5 Test result

Operation Mode	Temperature (℃)	Voltage (V)	Test Frequency (MHz)	Measured (dBuV)	Limit (dBuV emf)	Result
TX	25	13.8	160.650	-5.3	≤+6.0	Pass
		17.94	156.800	-4		
		12.42	157.425	-3.9		
	-15	17.94	160.650	-5.1	≤+12.0	
			156.800	-3.9		
			157.425	-3		
		12.42	160.650	-5		
			156.800	3.7		
			157.425	-3.4		
	55	17.94	160.650	-5.2		
			156.800	-3.9		
			157.425	-3.1		
		12.42	160.650	-5.1		
			156.800	-3.9		
			157.425	-3.3		

4.1.6 Result

The equipment met the requirement of this clause.

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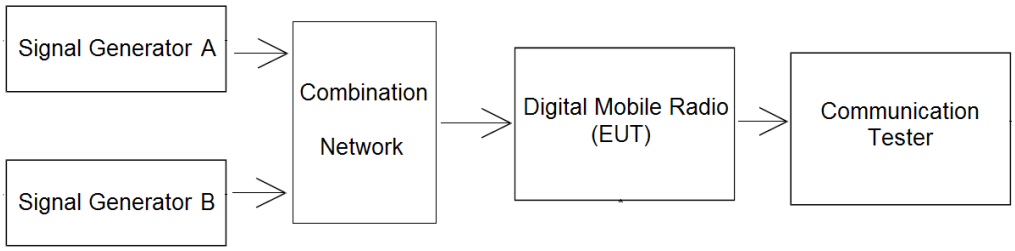
4.2 Receiver co-channel rejection

4.2.1 Definition

The co-channel rejection is a measure of the capability of the receiver to receive a wanted modulated signal without exceeding a given degradation due to the presence of an unwanted modulated signal, both signals being at the nominal frequency of the receiver.

4.2.2 TEST CONFIGURATION / SIGNAL



4.2.3 TEST PROCEDURE

ETSI EN 301 025-1Sub-clause 9.4.2 :

The two input signals shall be connected to the receiver via a combining network (see clause 6.1). The wanted signal shall have normal test modulation
(25 kHz channels: 1 kHz and the frequency deviation shall be ±3 kHz.
12,5 kHz channels: 1 kHz and the frequency deviation shall be ±1,5 kHz).
The unwanted signal shall be modulated by 400 Hz with a deviation of ±3 kHz (see note). Both input signals shall be at the nominal frequency of the receiver under test and the measurement repeated for displacements of the unwanted signal of ±3 kHz (see note).
The wanted input signal shall be set to the value corresponding to the measured maximum usable sensitivity (as measured at 4.1). The amplitude of the unwanted input signal shall then be adjusted until the SINAD ratio (psophometrically weighted) at the output of the receiver is reduced to 14 dB.
The co-channel rejection ratio shall be expressed as the ratio in dB of the level of the unwanted signal to the level of the wanted signal at the receiver input for which the specified reduction in SINAD ratio occurs.

NOTE: For 12,5 kHz channels the frequency deviation and the displacement of the unwanted signal is ±1,5 kHz.

4.2.4 LIMIT

The co-channel rejection ratio, at any frequency of the unwanted signal within the specified range, shall be between:

-10 dB and 0 dB for 25 kHz channels;
-12 dB and 0 dB for 12,5 kHz channel

4.2.5 Test result

Op 3 = 25 KHz RX				
Test Frequency (MHz)	Measurement Offset (KHz)	SG B – SG A (dB)	Limit	Result
160.650	-3	-9.3	-10～0	Pass
	0	-8.8		
	3	-8.1		
156.800	-3	-9.4		
	0	-7.9		
	3	-8.2		
157.425	-3	-9.6		
	0	-8.1		
	3	-7.8		

4.2.6 Result

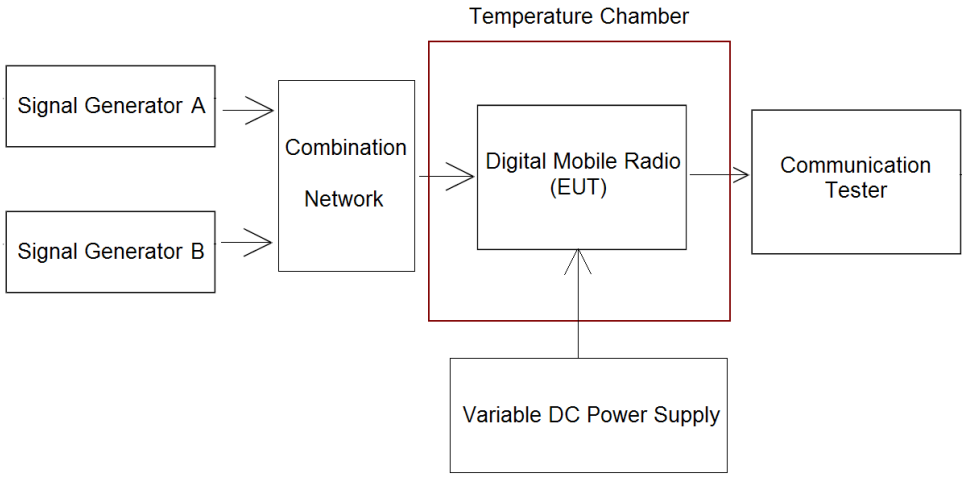
The equipment met the requirement of this clause.

4.3 Receiver Adjacent Channel Selectivity

4.3.1 Definition

The adjacent channel selectivity is a measure of the capability of the receiver to receive a wanted modulated signal without exceeding a given degradation due to the presence of an unwanted signal which differs in frequency from the wanted signal by an amount equal to the adjacent channel separation for which the equipment is intended.

4.3.2 TEST CONFIGURATION



4.3.3 TEST PROCEDURE

ETSI EN 301 025-1Sub-clause 9.5.2:

The two input signals shall be applied to the receiver input via a combining network. The wanted signal shall be at the nominal frequency of the receiver and shall have normal test modulation. The unwanted signal shall be modulated by 400 Hz with a deviation of ±3 kHz for 25 kHz channels or ±1,5 kHz for 12,5 kHz channels, and shall be at the frequency of the channel immediately above that of the wanted signal.

The wanted input signal level shall be set to the value corresponding to the maximum usable sensitivity. The amplitude of the unwanted input signal shall then be adjusted until the SINAD ratio at the receiver output, psophometrically weighted, is reduced to 14 dB. The measurement shall be repeated with an unwanted signal at the frequency of thechannel below that of the wanted signal.

The adjacent channel selectivity shall be expressed as the lower value of the ratios in dB for the upper and loweradjacent channels of the level of the unwanted signal to the level of the wanted signal.

The measurements shall then be repeated under extreme test conditions (see clauses 6.14.1 and 6.14.2 applied simultaneously) with the wanted signal set to the value corresponding to the maximum usable sensitivity under theseconditions.

4.3.4 LIMIT

	Channel separation	
	12.5 KHz	25 KHz
Normal test conditions	60.0 dB	70.0 dB
Extreme test conditions	50.0 dB	60.0 dB

4.3.5 Test result

Op 3 25KHz RX						
Test Condition		Test Frequency (MHz)	Measurement Position	SG B – SG A (dB)	Limit (dB)	Result
Temperature (℃)	Voltage (V)					
25	13.8	160.650	Lower adjacent	70.2	⩾70	Pass
			Upper adjacent	71.8		
		156.800	Lower adjacent	70.6		
			Upper adjacent	70.8		
		157.425	Lower adjacent	70.5		
			Upper adjacent	71.8		
-15	17.94	160.650	Lower adjacent	70.1	⩾60	Pass
			Upper adjacent	71.7		
		156.800	Lower adjacent	70.6		
			Upper adjacent	70.9		
		157.425	Lower adjacent	70.5		
			Upper adjacent	71.2		
	12.42	160.650	Lower adjacent	70.5	⩾60	Pass
			Upper adjacent	71.8		
		156.800	Lower adjacent	70.4		
			Upper adjacent	70.8		
		157.425	Lower adjacent	70.6		
			Upper adjacent	71.8		
55	17.94	160.650	Lower adjacent	70.2	⩾50	Pass
			Upper adjacent	70.8		
		156.800	Lower adjacent	70.6		
			Upper adjacent	70.4		
		157.425	Lower adjacent	70.3		
			Upper adjacent	71.8		
	12.42	160.650	Lower adjacent	70.2	⩾60	Pass
			Upper adjacent	71.2		
		156.800	Lower adjacent	70.6		
			Upper adjacent	70.9		
		157.425	Lower adjacent	70.5		
			Upper adjacent	71.6		

4.3.6 Result

The equipment met the requirement of this clause.

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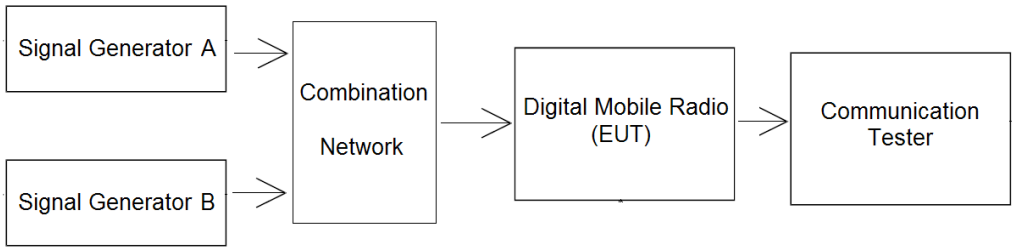
4.4 Receiver Spurious Response Rejection

4.4.1 Definition

The spurious response rejection is a measure of the capability of the receiver to receive a wanted modulated signal without exceeding a given degradation due to the presence of an unwanted modulated signal at any other frequency, at which a response is obtained.

4.4.2 TEST CONFIGURATION



4.4.3 TEST PROCEDURE

ETSI EN 301 025-1Sub-clause 9.6.2:

Two input signals shall be applied to the receiver input via a combining network. The wanted signal shall be at the nominal frequency of the receiver and shall have normal test modulation.

The unwanted signal shall be modulated by 400 Hz with a deviation of ±3 kHz.

The wanted input signal level shall be set to the value corresponding to the maximum usable sensitivity. The amplitude of the unwanted input signal shall be adjusted to an e.m.f. of +86 dBμV. The frequency shall then be swept over the frequency range from 100 kHz to 2 000 MHz.

At any frequency at which a response is obtained, the input level shall be adjusted until the SINAD ratio psophometrically weighted, is reduced to 14 dB.

The spurious response rejection ratio shall be expressed as the ratio in dB between the unwanted signal and the wanted signal at the receiver input when the specified reduction in the SINAD ratio is obtained.

4.4.4 LIMIT

At any frequency separated from the nominal frequency of the receiver by two channels or more, the spurious response rejection shall not be less than 70.0 dB

4.4.5 Test result

Op 3					
Test Frequency (MHz)	Relationship	Spurious Frequency (MHz)	SG B – SG A (dB)	Limit (dB)	Result
160.65	f_{RF1}-f_{LO}/2	149.95	72.1	⩾70	Pass
	f_{RF1}-2*f_{LO}	117.85	72.3		
	f_{LO}	21.4	71.8		
	2*f_{I1}-f_{LO}	257.1	71.7		
156.800	f_{RF2}-f_{LO}/2	146.1	71.4	⩾70	
	f_{RF2}-2*f_{LO}	114	72.5		
	f_{LO}	21.4	72.1		
	2*f_{I2}-f_{LO}	249.4	72.2		
157.425	f_{RF3}-f_{LO}/2	146.725	72.3	⩾70	
	f_{RF3}-2*f_{LO}	114.625	71.6		
	f_{LO}	21.4	71.8		
	2*f_{I3}-f_{LO}	250.65	72.3		

Remark:
1) fRF1=160.65MHz, fRF2=156.8MHz,fRF3=157.425MHz, fLO=21.4MHz, fI1=160.65MHz-21.4MHz=139.25MHz, fI2=156.8MHz-21.4MHz=135.4MHz fI3=157.425MHz-21.4MHz=136.025MHz
2) An increment sweep was made between 100 kHz - 2000 MHz with no other significant responses detected.

4.4.6 Result

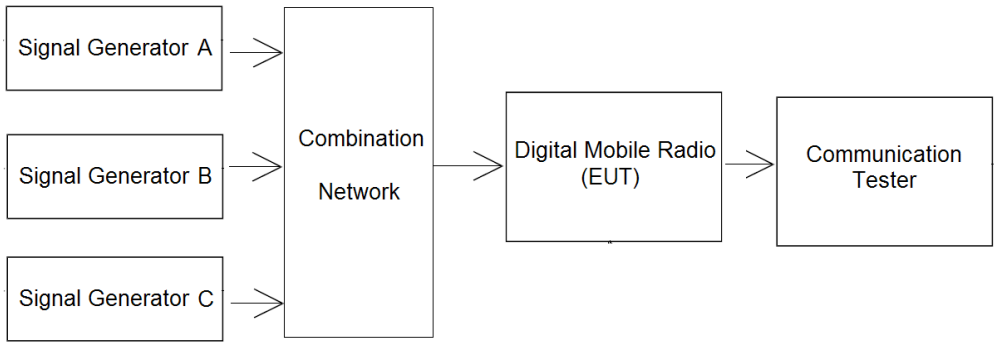
The equipment met the requirement of this clause.

4.5 Receiver Intermodulation response rejection

4.5.1 Definition

The intermodulation response rejection is a measure of the capability of the receiver to receive a wanted modulated signal, without exceeding a given degradation due to the presence of two or more unwanted signals with a specific frequency relationship to the wanted signal frequency.

4.5.2 TEST CONFIGURATION



4.5.3 TEST PROCEDURE

ETSI EN 301 025-1Sub-clause 9.7.2 :

Three signal generators, A, B and C shall be connected to the receiver via a combining network (see clause 6.1). The wanted signal, represented by signal generator A shall be at the nominal frequency of the receiver and shall have normal test modulation (see clause 6.4). The unwanted signal from signal generator B shall be unmodulated and adjusted to the frequency 50 kHz above (or below) the nominal frequency of the receiver. The second unwanted signal from signal generator C shall be modulated by 400 Hz with a deviation of ±3 kHz, and adjusted to a frequency 100 kHz above (or below) the nominal frequency of the receiver.

The wanted input signal shall be set to a value corresponding to the maximum usable sensitivity. The amplitude of the two unwanted signals shall be maintained equal and shall be adjusted until the SINAD ratio at the receiver output, psophometrically weighted, is reduced to 14 dB. The frequency of signal generator B shall be adjusted slightly to produce the maximum degradation of the SINAD ratio. The level of the two unwanted test signals shall be readjusted to restore the SINAD radio of 14 dB. The intermodulation response ratio shall be expressed as the ratio in dB between the two unwanted signals and the wanted signal at the receiver input, when the specified reduction in the SINAD ratio is obtained..

4.5.4 LIMIT

The intermodulation response ratio shall be greater than 68 dB.

4.5.5 Test result

Op 6					
Test Frequency (MHz)	Measurement Offset (KHz)		SG B/C – SG A (dB)	Limit (dB)	Result
	SG B	SG C			
160.65	-50	-100	72.3	≥68	Pass
	-25	-50	72.1		
	25	50	72.4		
	50	100	71.8		
156.800	-50	-100	71.6		
	-25	-50	72.4		
	25	50	72.1		
	50	100	72.3		
157.425	-50	-100	72.5		
	-25	-50	72.6		
	25	50	72.9		
	50	100	72.3		

4.5.6 Result

The equipment met the requirement of this clause.

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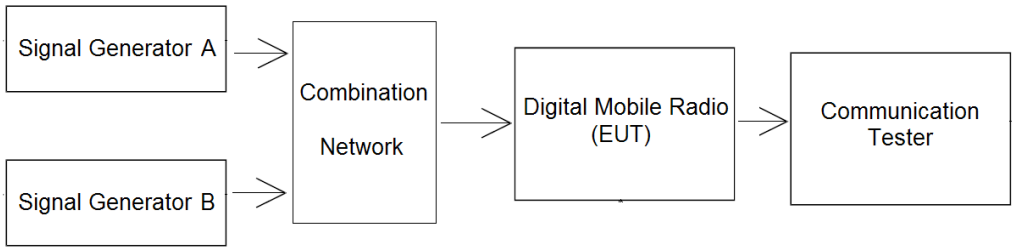
4.6 Receiver Blocking or Desensitization

4.6.1 Definition

Blocking is a measure of the capability of the receiver to receive a wanted modulated signal without exceeding a given degradation due to the presence of an unwanted input signal at any frequencies other than those of the spurious responses or the adjacent channels.

4.6.2 TEST CONFIGURATION



4.6.3 TEST PROCEDURE

ETSI EN 301 025-1Sub-clause 9.8.2 :

Spurious emissions shall be measured as the power level of any discrete signal at the input terminals of the receiver.

The receiver input terminals are connected to a spectrum analyser or selective voltmeter having an input impedance of 50 Ω and the receiver is switched on.

If the detecting device is not calibrated in terms of power input, the level of any detected components shall be determined by a substitution method using a signal generator.

The measurements shall extend over the frequency range of 9 kHz to 2 GHz..

4.6.4 LIMIT

The blocking level for any frequency within the specified ranges, shall be not less than 90 dBμV (e.m.f.), except at frequencies on which spurious responses are found (chapter 4.5 measurement)

4.6.5 Test result

Remark: We tested Op 5 (ch 276) to Op 6 (ch 16) ,recorded as below.

4.6.6 Test result

Op 3 25 KHz Rx Ch70				
Test Frequency (MHz)	Measurement Offset (MHz)	Measured (error ratio)	Limit (dBuV)	Result
160.65	-10	91.1	≥90	Pass
	-5	90.5		
	-2	90.8		
	-1	90.2		
	1	90.6		
	2	90.6		
	5	91.2		
	10	90.4		
156.800	-10	91.3		
	-5	90.2		
	-2	90.3		
	-1	90.2		
	1	90.2		
	2	90.4		
	5	90.6		
	10	90.1		
157.425	-10	90.1		
	-5	90.3		
	-2	90.7		
	-1	90.4		
	1	90.6		
	2	90.1		
	5	90.1		
	10	90.3		

4.6.7 Result

The equipment met the requirement of this clause.

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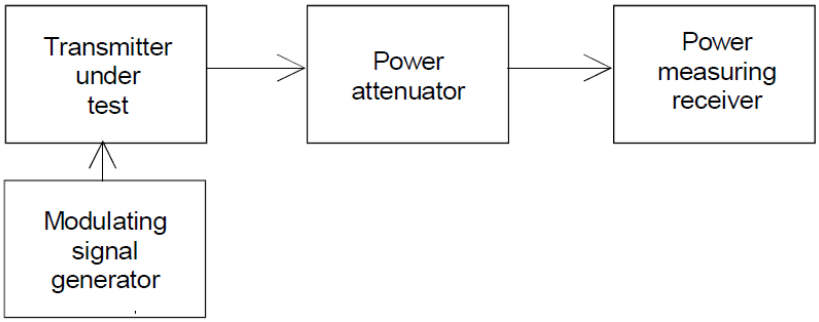
4.7 Receiver Spurious Emission - Conducted

4.7.1 Definition

Spurious radiations from the receiver are emissions at any frequency, radiated by the equipment and its antenna.

4.7.2 TEST CONFIGURATION



4.7.3 TEST PROCEDURE

ETSI EN 301 025-1Sub-clause 9.9.2 :

Two input signals shall be applied to the receiver via a combining network The modulated wanted signal shall be at the nominal frequency of the receiver and shall have normal test modulation. Initially the unwanted signal shall be switched off and the wanted signal set to the value corresponding to the maximum usable sensitivity.

The output power of the wanted signal shall be adjusted, where possible, to 50 % of the rated output power and in the case of stepped volume controls, to the first step that provides an output power of at least 50 % of the rated output power. The unwanted signal shall be unmodulated and the frequency shall be swept between +1 MHz and +10 MHz, and also between -1 MHz and -10 MHz, relative to the nominal frequency of the receiver. For practical reasons the measurements will be carried out at frequency offsets of the unwanted signal at approximately 1 MHz, 2 MHz, 5 MHz and 10 MHz.

The input level of the unwanted signal, at all frequencies in the specified ranges, shall be so adjusted that the unwanted signal causes:

a) a reduction of 3 dB in the output level of the wanted signal; or

b) a reduction to 14 dB of the SINAD ratio at the receiver output using a psophometric telephone filtering network such as described in Recommendation ITU-T O.41 [i.6] whichever occurs first. This level shall be noted.

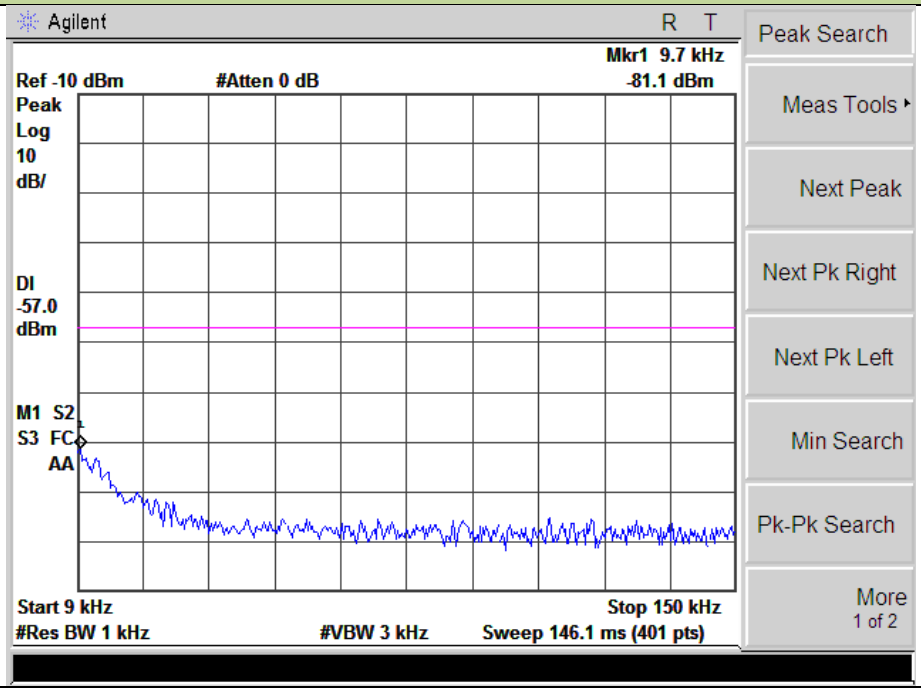
4.7.4 LIMIT

The power of any spurious emission shall not exceed 2 nW at any frequency in the range between 9 kHz and 2 GHz

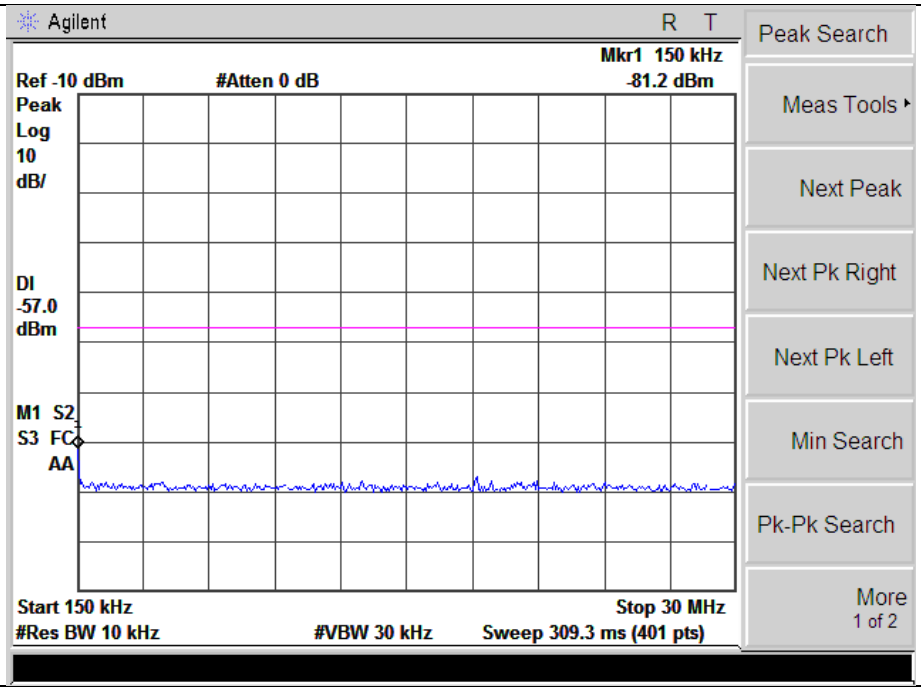
4.7.5 TEST RESULTS

Test plot as follows:

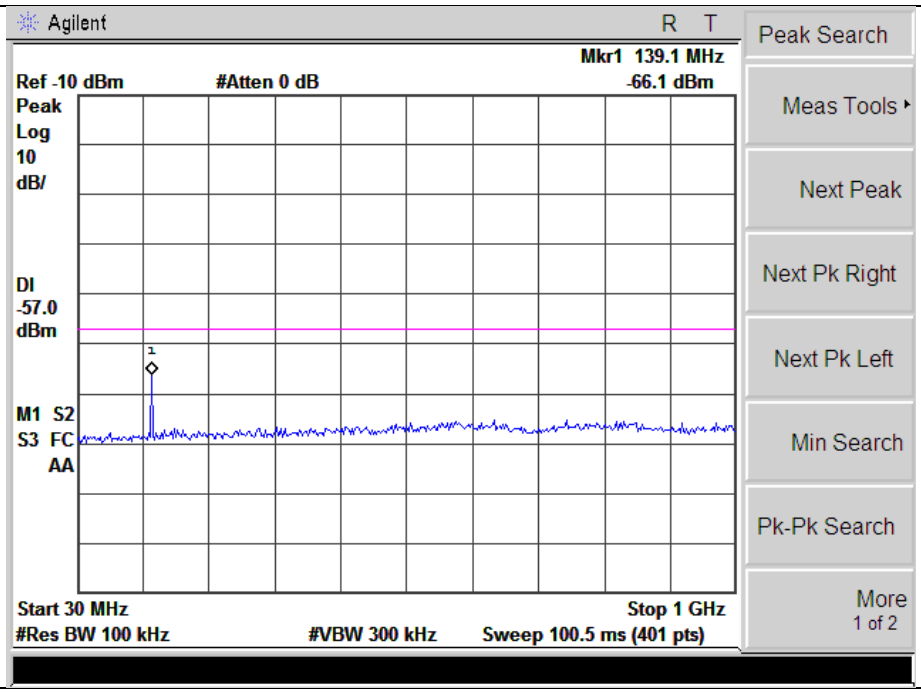
Op 3 –CH1



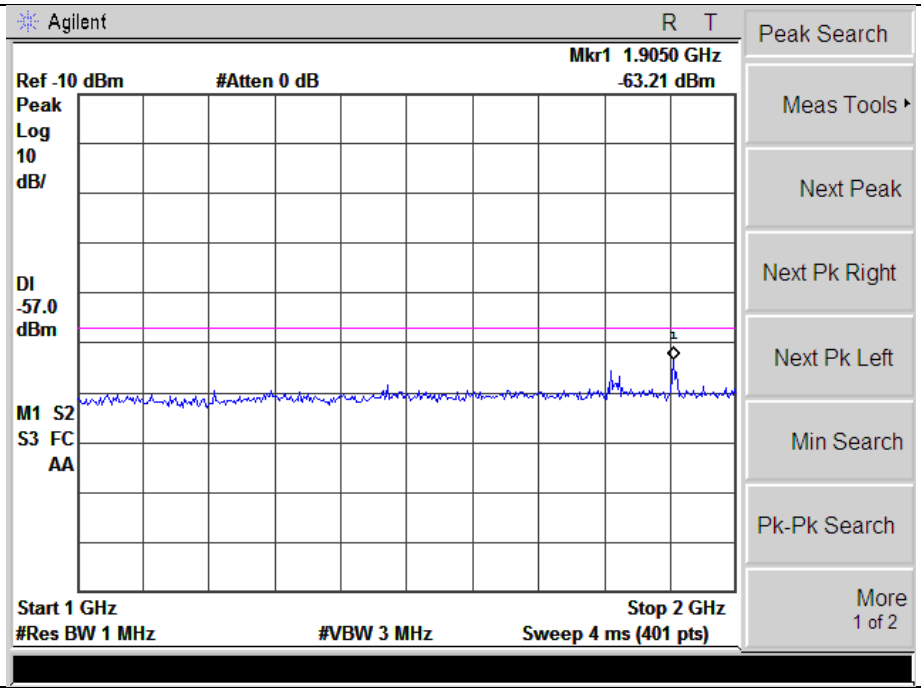
9KHz-150KHz



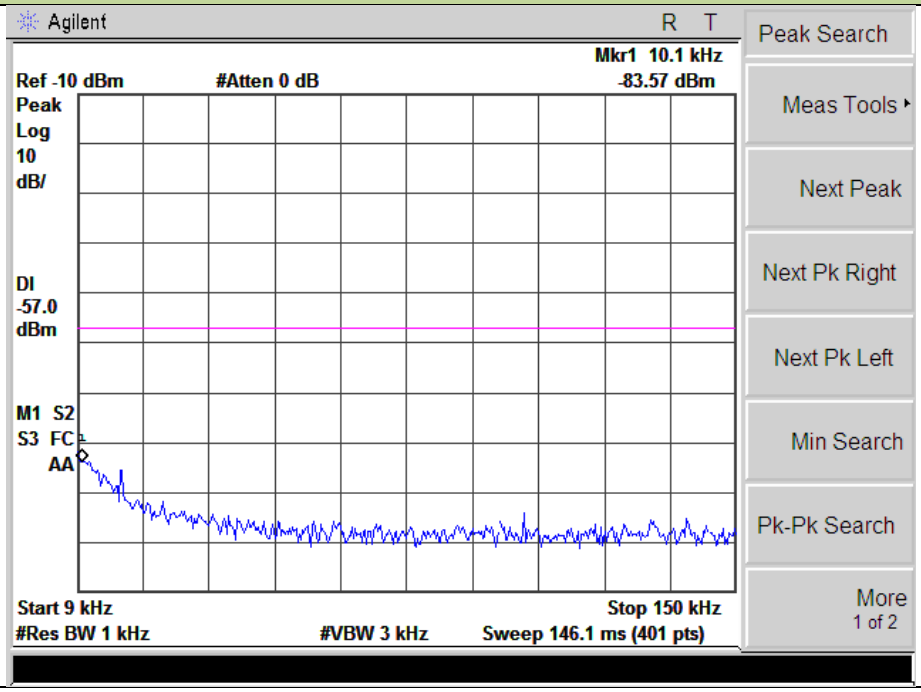
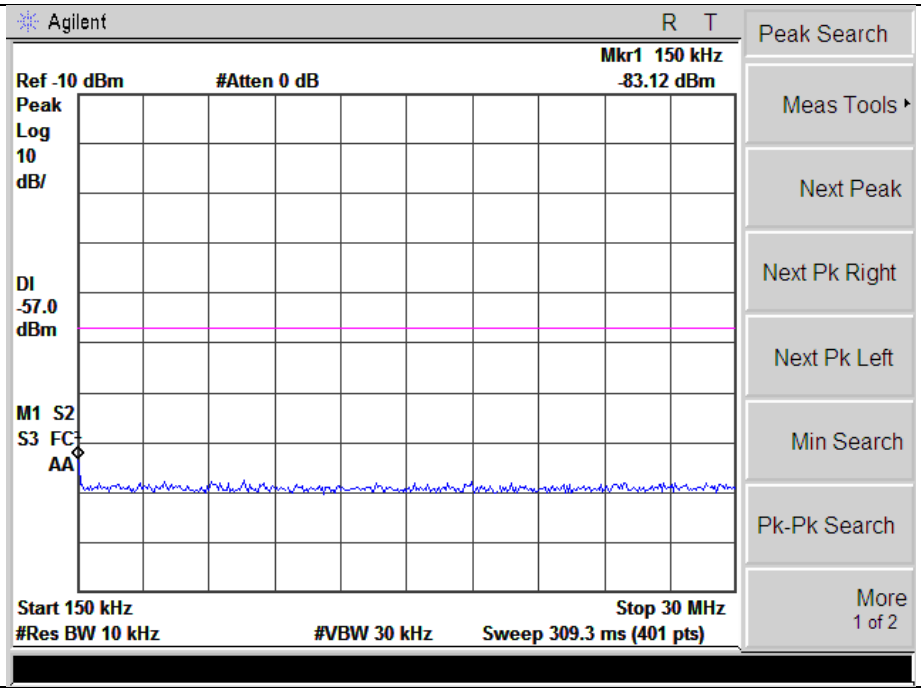
150KHz-30MHz

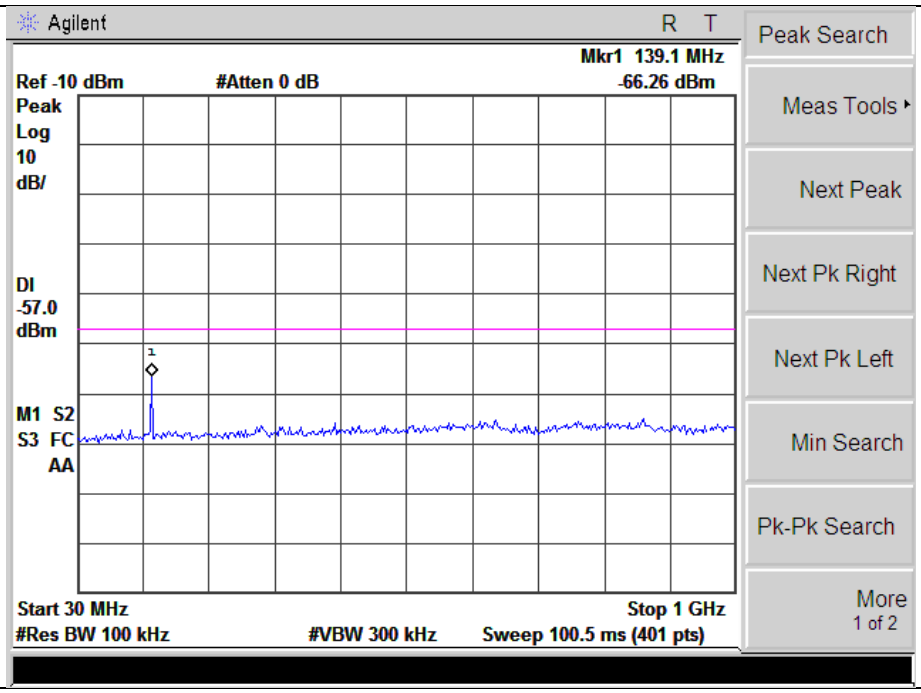


30MHz-1000MHz

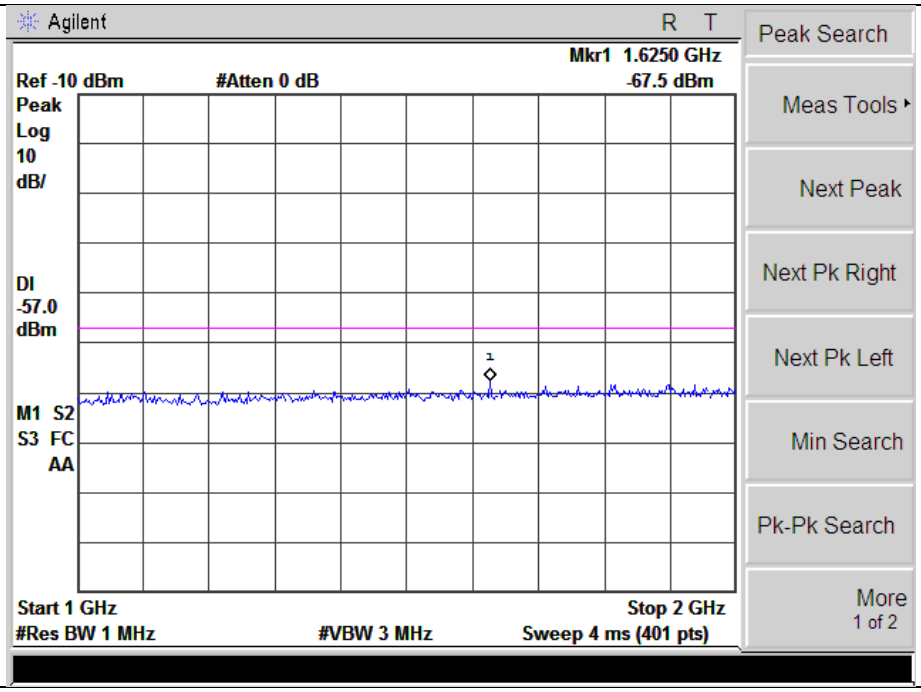


1GHz-2.00GHz

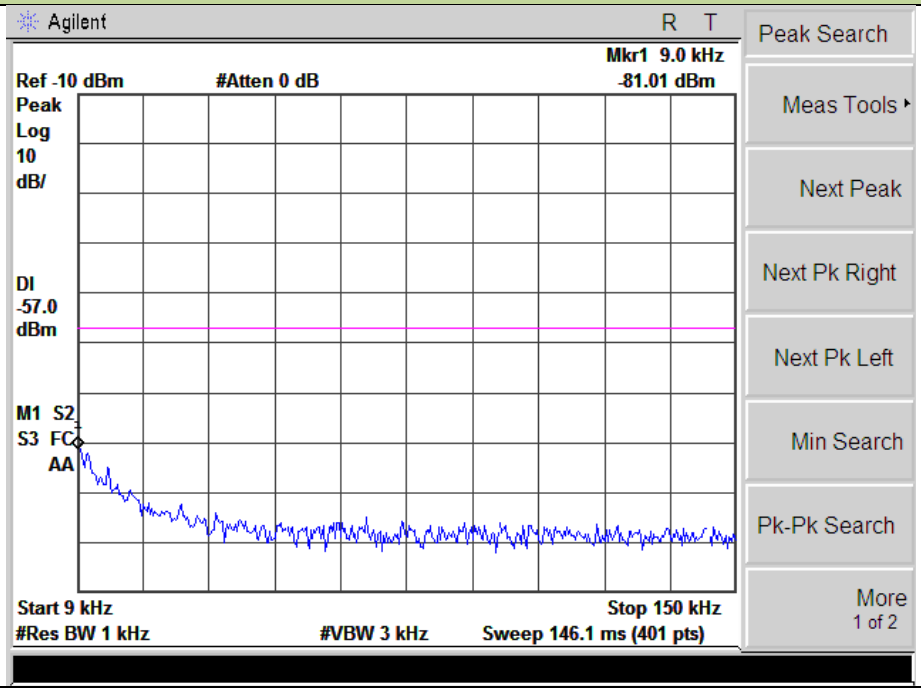
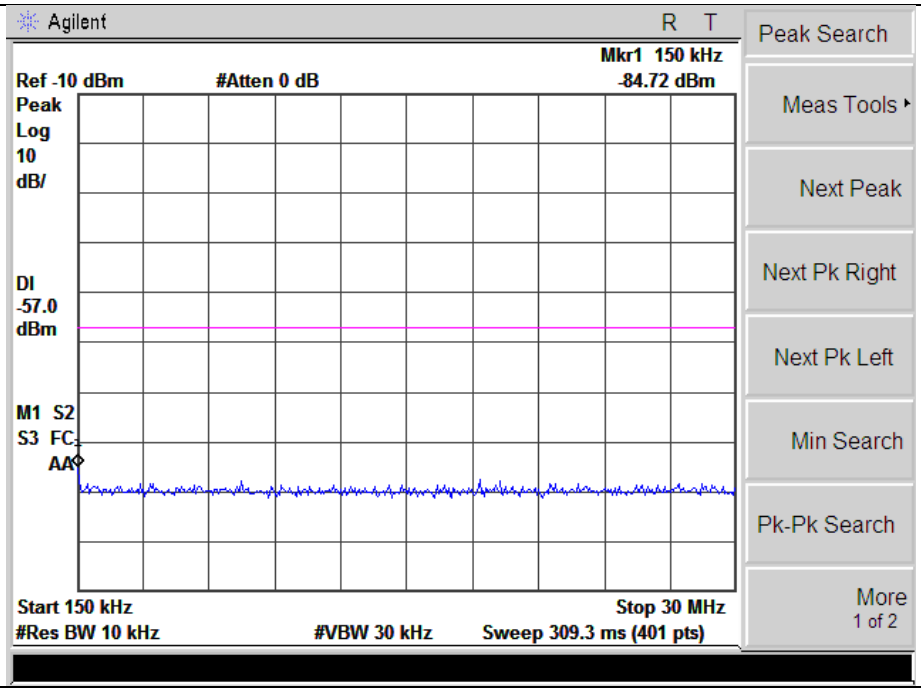
Op 3-CH16

9KHz-150KHz

150KHz-30MHz



30MHz-1000MHz



1GHz-2.00GHz

Op 3 –CH70

9KHz-150KHz

150KHz-30MHz

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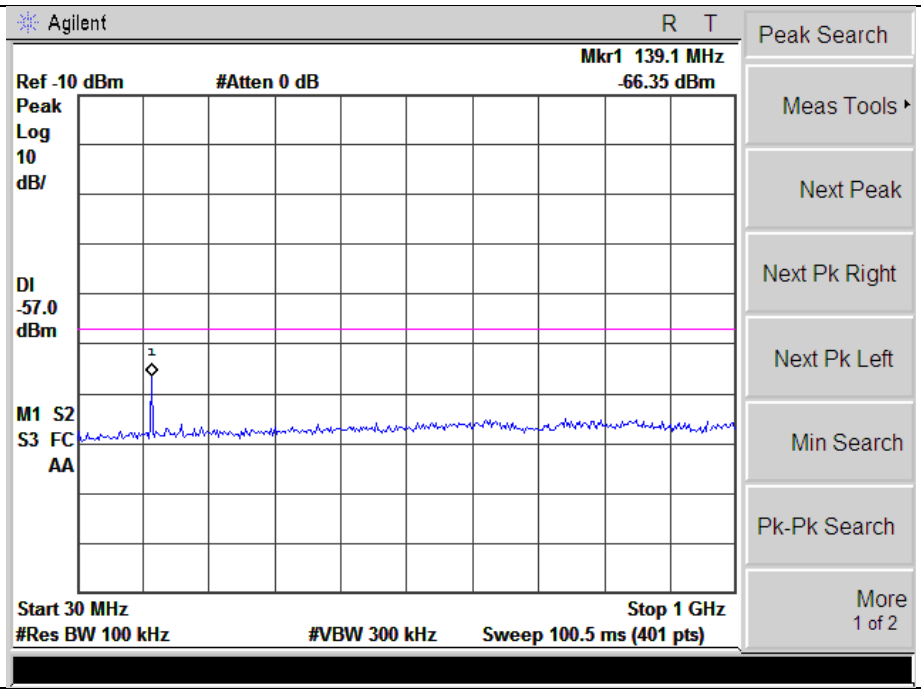
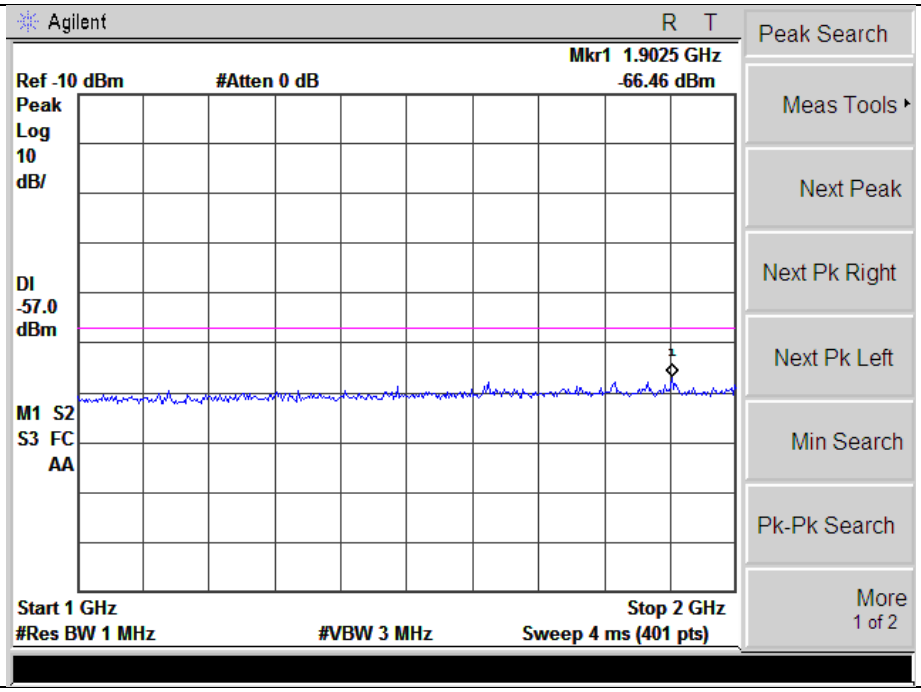
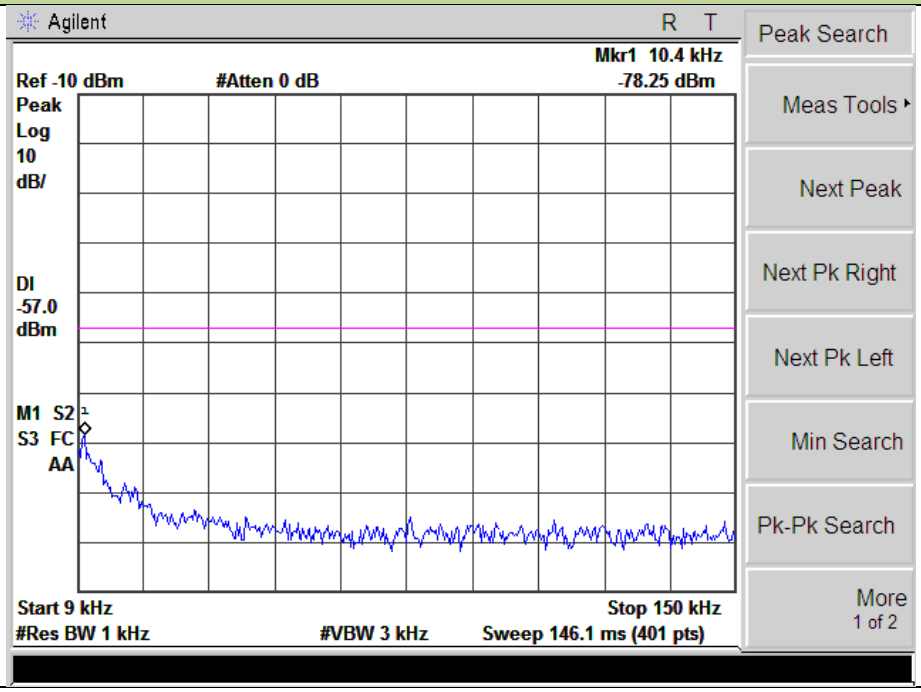
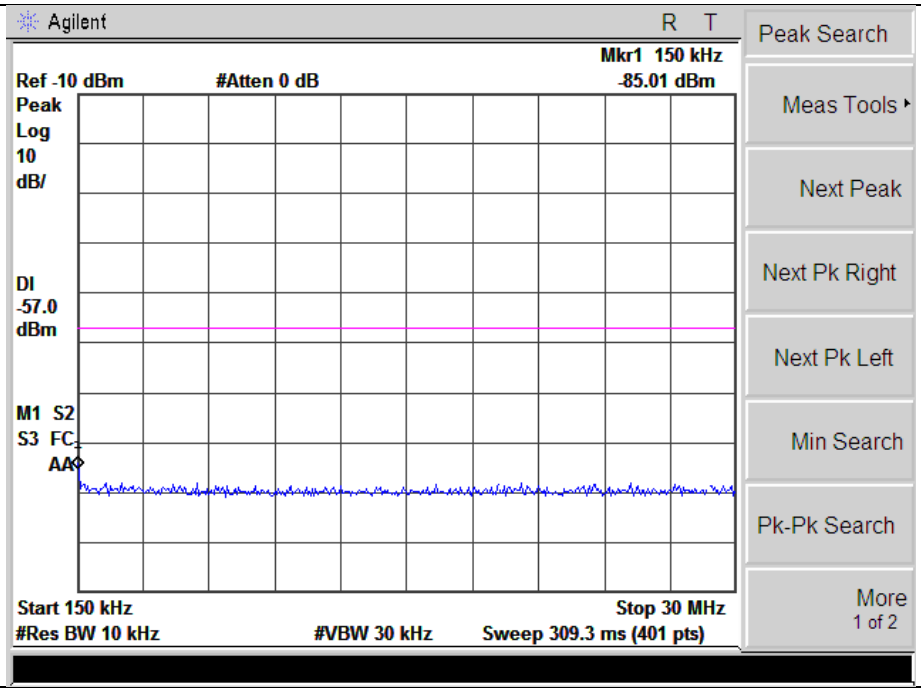
Shenzhen City, 518052, P. R. China Tel. +86 755 8828 6998, Fax: +86 755 8828 5299

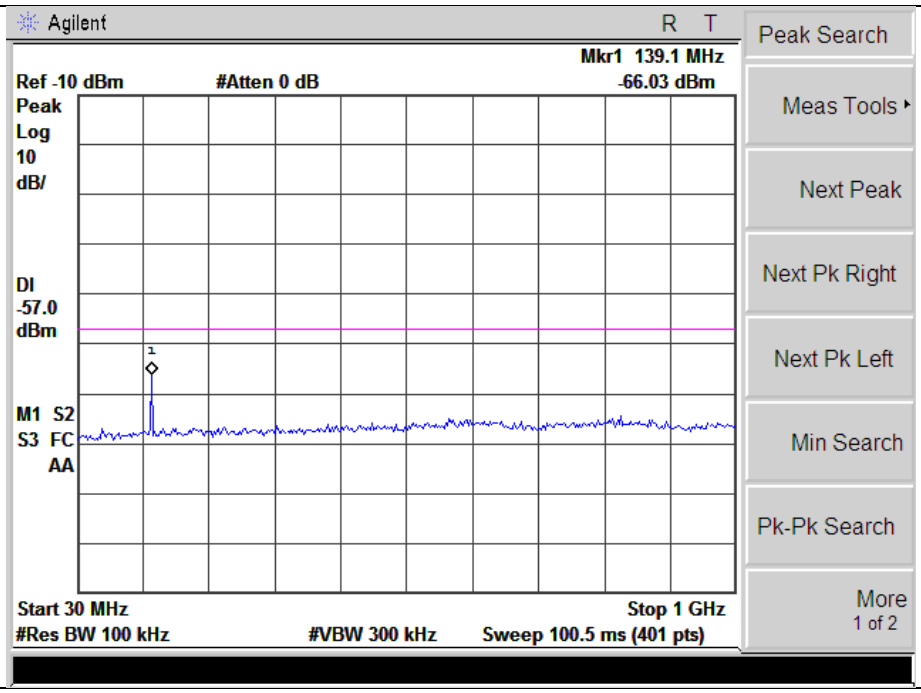


30MHz-1000MHz

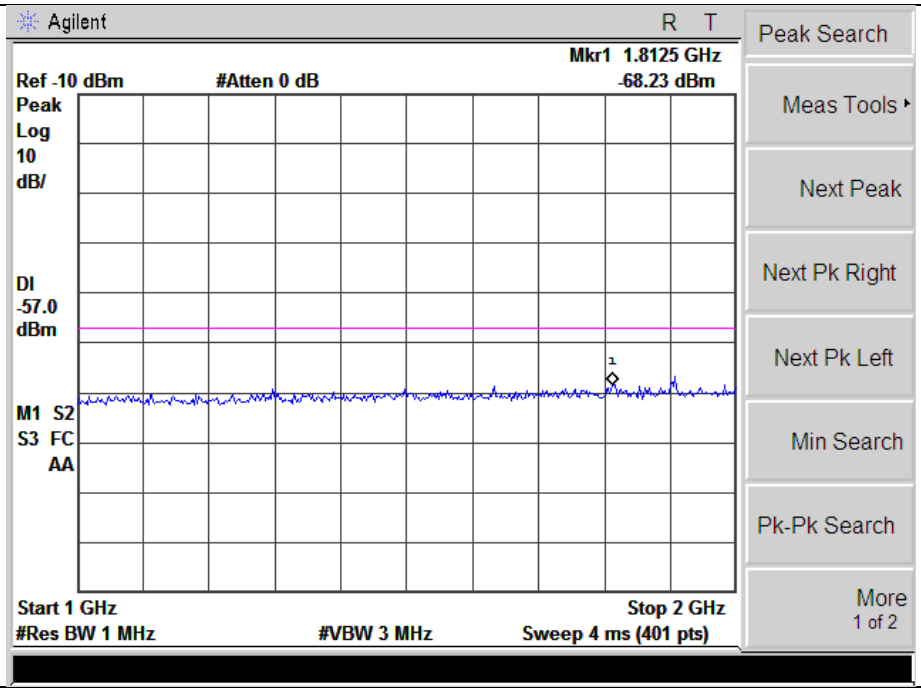


1GHz-2.00GHz

Op 3-CH88

9KHz-150KHz

150KHz-30MHz



30MHz-1000MHz



1GHz-2.00GHz

4.7.6 Result

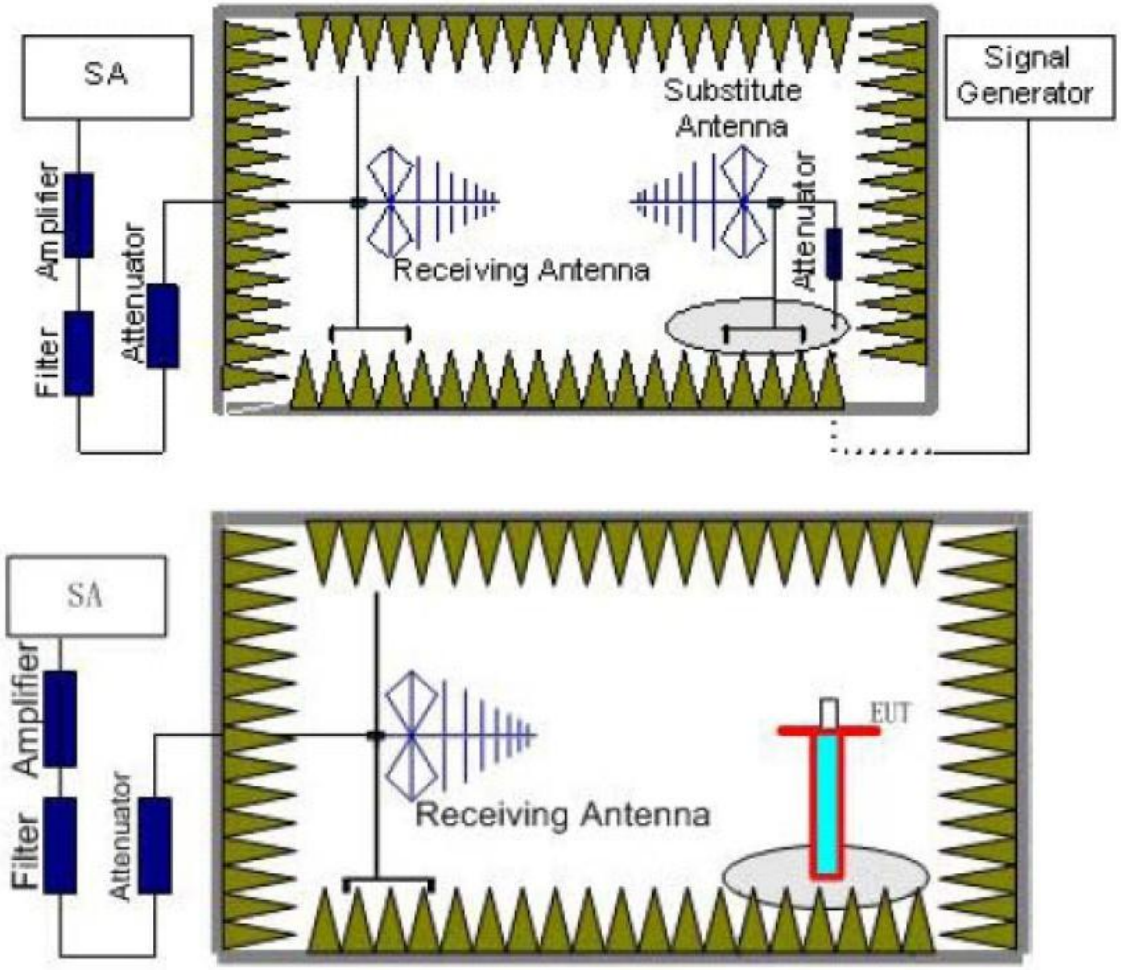
The equipment met the requirement of this clause.

4.8 Receiver Spurious Emission - Radiated

4.8.1 Definition

Spurious radiations from the receiver are emissions at any frequency, radiated by the equipment and its antenna.

4.8.2 TEST CONFIGURATION



4.8.3 TEST PROCEDURE

ETSI EN 301 025-1Sub-clause 9.10.2 :

On a test site, selected from annex B, the equipment shall be placed at the specified height on a non-conducting support and in position closest to normal use as declared by the manufacturer.
The test antenna shall be orientated for vertical polarization and the length of the test antenna shall be chosen to correspond to the instantaneous frequency of the measuring receiver.
The output of the test antenna shall be connected to a measuring receiver.
The receiver shall be switched on without modulation, and measuring receiver shall be tuned over the frequency range 30 MHz to 2 GHz.
At each frequency at which a spurious component is detected:
a) the test antenna shall be raised and lowered through the specified range of heights until a maximum signal level is detected on the measuring receiver;
b) the receiver shall be rotated through 360° in the horizontal plane, until the maximum signal level is detected by the measuring receiver;
c) the maximum signal level detected by the measuring receiver shall be noted;
d) the receiver shall be replaced by a substitution antenna as defined in annex B;

e) the substitution antenna shall be orientated for vertical polarization and the length of the substitution antenna shall be adjusted to correspond to the frequency of the spurious component detected;
f) the substitution antenna shall be connected to a calibrated signal generator;
g) the frequency of the calibrated signal generator shall be set to the frequency of the spurious component detected;
h) the input attenuator setting of the measuring receiver shall be adjusted in order to increase the sensitivity of the measuring receiver, if necessary;
i) the test antenna shall be raised and lowered through the specified range of heights to ensure that the maximum signal is received;
j) the input signal to the substitution antenna shall be adjusted to the level that produces a level detected by the measuring receiver that is equal to the level noted while the spurious component was measured, corrected for the change of input attenuator setting of the measuring receiver;
k) the input level to the substitution antenna shall be recorded as power level, corrected for the change of input attenuator setting of the measuring receiver;
l) the measurement shall be repeated with the test antenna and the substitution antenna orientated for horizontal polarization;
m) the measure of the effective radiated power of the spurious components is larger of the two power levels recorded for spurious component at the input to the substitution antenna, corrected for the gain of the antenna if necessary.

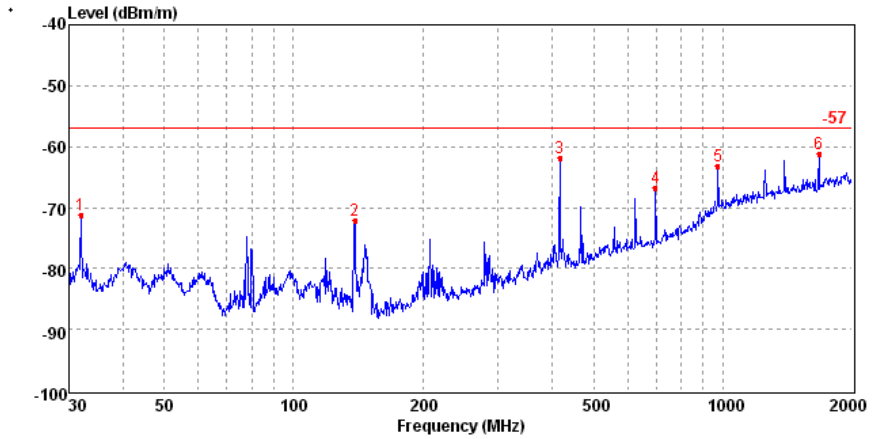
4.8.4 LIMIT

The power of any spurious emission shall not exceed 2 nW at any frequency in the range between 9 kHz and 2 GHz

4.8.5 TEST RESULTS

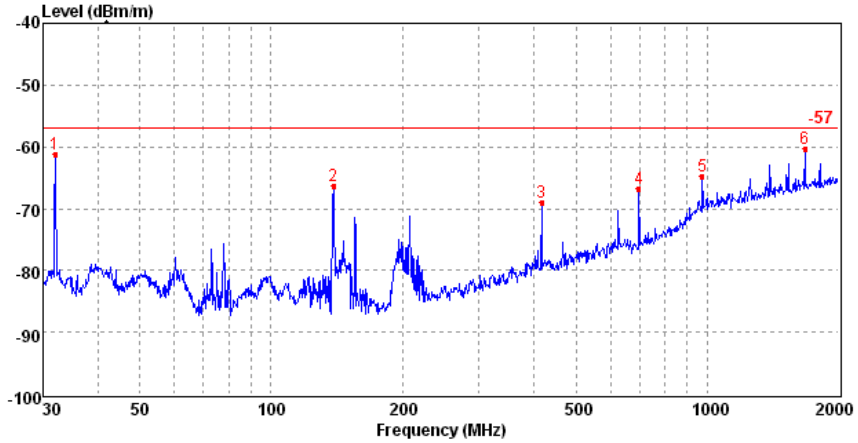
Test plot as follows:

Op 3			
Test Frequency:	156.05MHz	Polarity:	Horizontal



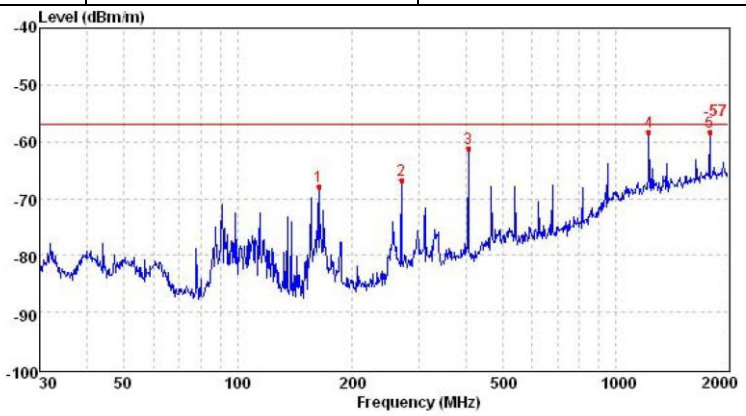
Mark	Frequency MHz	Reading dBm	Antenna dB	Cable dB	Preamp dB	Level dBm	Limit dBm	Over limit	Remark
1	31.95	-69.53	25.51	0.52	27.76	-71.26	-57.00	-14.26	Peak
2	138.95	-66.74	22.10	1.24	28.62	-72.02	-57.00	-15.02	Peak
3	417.55	-63.84	28.53	2.31	28.90	-61.90	-57.00	-4.90	Peak
4	696.99	-73.31	32.02	3.13	28.64	-66.80	-57.00	-9.80	Peak
5	975.31	-76.14	37.58	3.65	28.35	-63.26	-57.00	-6.26	Peak
6	1676.59	-78.61	40.43	5.05	28.10	-61.23	-57.00	-4.23	Peak

Test Frequency:	156.05MHz	Polarity:	Vertical



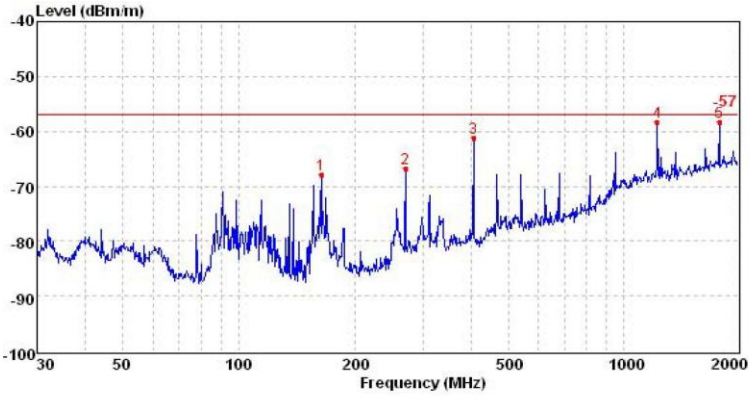
Mark	Frequency MHz	Reading dBm	Antenna dB	Cable dB	Preamp dB	Level dBm	Limit dBm	Over limit	Remark
1	31.95	-59.51	25.51	0.52	27.76	-61.24	-57.00	-4.24	Peak
2	138.95	-61.05	22.10	1.24	28.62	-66.33	-57.00	-9.33	Peak
3	417.55	-71.04	28.53	2.31	28.90	-69.10	-57.00	-12.10	Peak
4	696.99	-73.38	32.02	3.13	28.64	-66.87	-57.00	-9.87	Peak
5	975.31	-77.60	37.58	3.65	28.35	-64.72	-57.00	-7.72	Peak
6	1676.59	-77.77	40.43	5.05	28.10	-60.39	-57.00	-3.39	Peak

Op 3			
Test Frequency:	156.80MHz	Polarity:	Horizontal



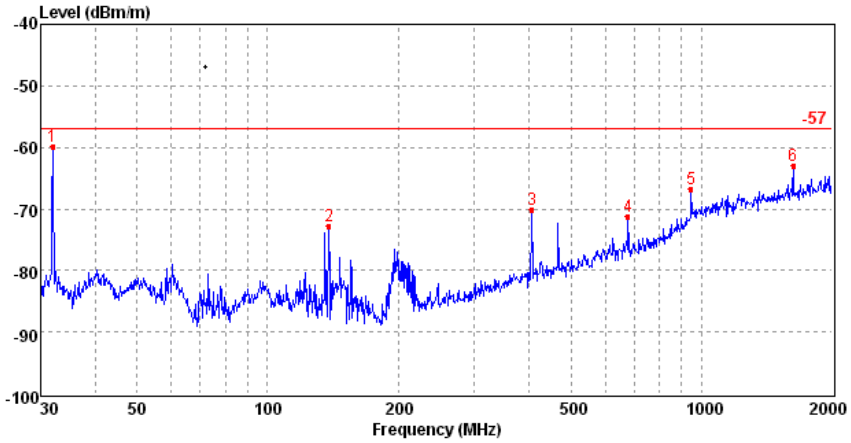
Mark	Frequency MHz	Reading dBm	Antenna dB	Cable dB	Preamp dB	Level dBm	Limit dBm	Over limit	Remark
1	164.10	-62.44	21.98	1.36	28.70	-67.80	-57.00	-10.80	Peak
2	271.09	-65.20	25.50	1.81	28.84	-66.73	-57.00	-9.73	Peak
3	406.56	-63.00	28.35	2.28	28.89	-61.26	-57.00	-4.26	Peak
4	1222.14	-73.40	39.18	4.17	28.24	-58.29	-57.00	-1.29	Peak
5	1766.53	-76.13	40.61	5.20	28.08	-58.40	-57.00	-1.40	Peak

Test Frequency:	156.80MHz	Polarity:	Vertical



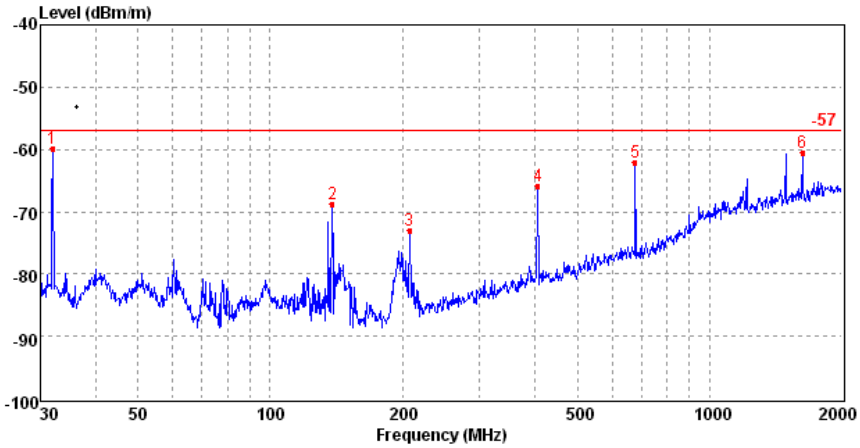
Mark	Frequency MHz	Reading dBm	Antenna dB	Cable dB	Preamp dB	Level dBm	Limit dBm	Over limit	Remark
1	164.10	-62.44	21.98	1.36	28.70	-67.80	-57.00	-10.80	Peak
2	271.09	-65.20	25.50	1.81	28.84	-66.73	-57.00	-9.73	Peak
3	406.56	-63.00	28.35	2.28	28.89	-61.26	-57.00	-4.26	Peak
4	1222.14	-73.40	39.18	4.17	28.24	-58.29	-57.00	-1.29	Peak
5	1766.53	-76.13	40.61	5.20	28.08	-58.40	-57.00	-1.40	Peak

Op 3			
Test Frequency:	CH70	Polarity:	Horizontal



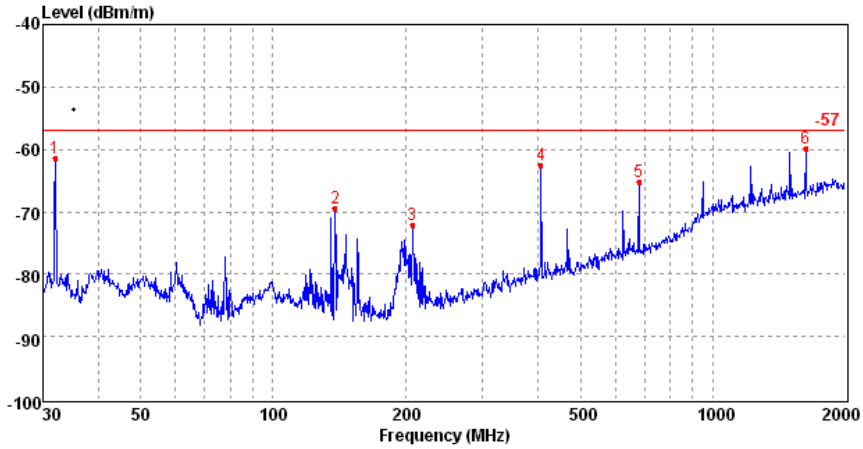
Mark	Frequency MHz	Reading dBm	Antenna dB	Cable dB	Preamp dB	Level dBm	Limit dBm	Over limit	Remark
1	31.95	-58.09	25.51	0.52	27.76	-59.82	-57.00	-2.82	Peak
2	138.36	-67.49	22.18	1.24	28.62	-72.69	-57.00	-15.69	Peak
3	407.16	-71.75	28.35	2.28	28.89	-70.01	-57.00	-13.01	Peak
4	676.80	-77.51	31.94	3.08	28.66	-71.15	-57.00	-14.15	Peak
5	947.05	-78.77	36.64	3.64	28.37	-66.86	-57.00	-9.86	Peak
6	1628.02	-80.16	40.34	4.97	28.12	-62.97	-57.00	-5.97	Peak

Test Frequency:	CH70	Polarity:	Vertical



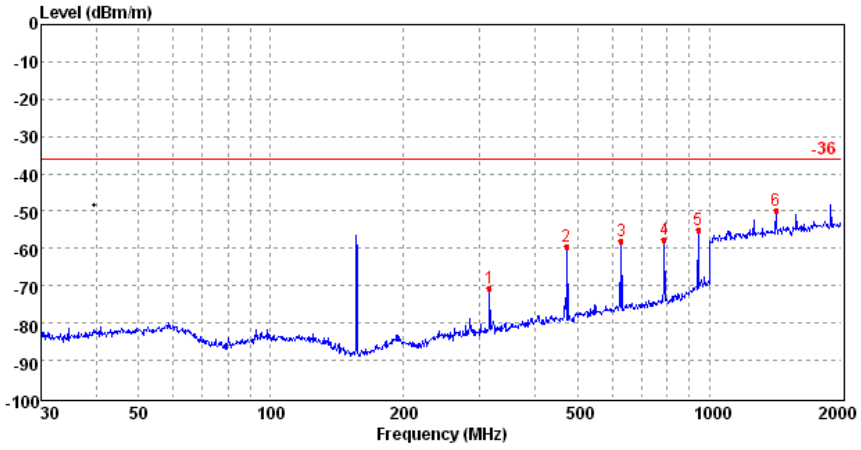
Mark	Frequency MHz	Reading dBm	Antenna dB	Cable dB	Preamp dB	Level dBm	Limit dBm	Over limit	Remark
1	31.95	-58.03	25.51	0.52	27.76	-59.76	-57.00	-2.76	Peak
2	138.36	-63.46	22.18	1.24	28.62	-68.66	-57.00	-11.66	Peak
3	207.94	-69.55	23.85	1.56	28.80	-72.94	-57.00	-15.94	Peak
4	407.16	-67.65	28.35	2.28	28.89	-65.91	-57.00	-8.91	Peak
5	676.80	-68.38	31.94	3.08	28.66	-62.02	-57.00	-5.02	Peak
6	1628.02	-77.75	40.34	4.97	28.12	-60.56	-57.00	-3.56	Peak

Op 3			
Test Frequency:	157.425MHz	Polarity:	Horizontal



Mark	Frequency MHz	Reading dBm	Antenna dB	Cable dB	Preamp dB	Level dBm	Limit dBm	Over limit	Remark
1	31.95	-59.59	25.51	0.52	27.76	-61.32	-57.00	-4.32	Peak
2	138.36	-64.29	22.18	1.24	28.62	-69.49	-57.00	-12.49	Peak
3	207.94	-68.77	23.85	1.56	28.80	-72.16	-57.00	-15.16	Peak
4	407.16	-64.29	28.35	2.28	28.89	-62.55	-57.00	-5.55	Peak
5	679.65	-71.59	31.96	3.08	28.66	-65.21	-57.00	-8.21	Peak
6	1628.02	-77.00	40.34	4.97	28.12	-59.81	-57.00	-2.81	Peak

Test Frequency:	157.425MHz	Polarity:	Vertical



Mark	Frequency MHz	Reading dBm	Antenna dB	Cable dB	Preamp dB	Level dBm	Limit dBm	Over limit	Remark
1	315.37	-70.34	26.55	1.97	28.86	-70.68	-36.00	-34.68	Peak
2	472.55	-62.55	29.39	2.43	28.91	-59.64	-36.00	-23.64	Peak
3	630.49	-64.06	31.78	2.95	28.72	-58.05	-36.00	-22.05	Peak
4	789.62	-65.39	33.15	3.28	28.53	-57.49	-36.00	-21.49	Peak
5	944.72	-67.09	36.64	3.64	28.37	-55.18	-36.00	-19.18	Peak
6	1417.16	-66.14	39.82	4.57	28.17	-49.92	-36.00	-13.92	Peak

4.8.6 Result

The equipment met the requirement of this clause.

4.9 DSC Receiver Maximum Usable Sensitivity

4.9.1 Definition

The maximum usable sensitivity of the receiver is the minimum level of the signal (e.m.f.) at the nominal frequency of the receiver which when applied to the receiver input with a test modulation will produce a bit error ratio of 10^{-2}.

4.9.2 TEST CONFIGURATION / SIGNAL

Standard test signals for DSC = The standard test signal for a VHF DSC decoder shall be a phase-modulated signal at VHF channel 70 with modulation index = 2. The modulating signal shall have a nominal frequency of 1700 Hz and a frequency shift of ±400 Hz with a modulation rate of 1 200 baud.

Standard test signals shall consist of a series of identical call sequences, each of which contain a known number of information symbols Standard test signals shall be of sufficient length for the measurements to be performed or it shall be possible to repeat them without interruption to make the measurements.

4.9.3 TEST PROCEDURE

ETSI EN 301 025-1Sub-clause 10.1.2 :
DSC standard test signal containing DSC calls shall be applied to the receiver input. The input level shall be 0 dBµV under normal test conditions and +6 dBµV under extreme test conditions
The measurement shall be repeated under normal test conditions at the nominal carrier frequency ±1,5 kHz.
The bit error ratio in the decoder output shall be determined as :
The information content of the decoded call sequence displayed at the readout device of the receiving part shall be divided into blocks, each of which corresponds to one information symbol in the applied test signal.
Bit error rate = total number of incorrect information symbols relative to the total number of information symbols shall be registered.

4.9.4 LIMIT

The bit error ratio shall be equal to or less than 10^{-2}.

4.9.5 Test result

Operation Mode	Temperature (℃)	Voltage (V)	Test Frequency (MHz)	Measured (dBuV)	Limit (dBuV emf)	Result
B+Y- state	25	13.8	156.525	0.0084	$\leqslant 10^{-2}$	Pass
	-15	17.94	156.525	0.0047	$\leqslant 10^{-2}$	
		12.42	156.525	0.0059		
	55	17.94	156.525	0.0037		
		12.42	156.525	0.0044		

4.9.6 Result

The equipment met the requirement of this clause.

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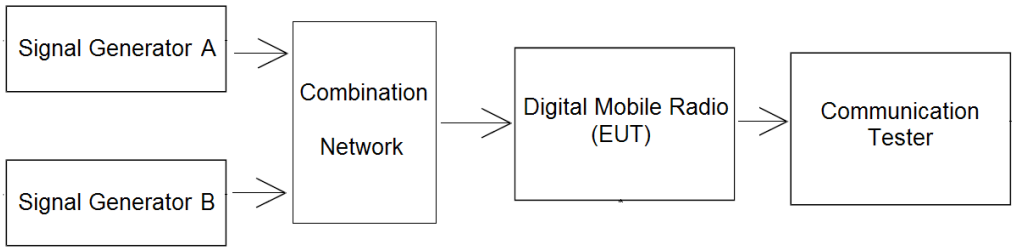
4.10 Receiver DSC Co- Channel rejection

4.10.1 Definition

The co-channel rejection is a measure of the capability of the receiver to receive a wanted modulated signal without exceeding a given degradation due to the presence of an unwanted modulated signal, both signals being at the nominal frequency of the receiver.

4.10.2 TEST CONFIGURATION / SIGNAL



Standard test signals for DSC = The standard test signal for a VHF DSC decoder shall be a phase-modulated signal at VHF channel 70 with modulation index = 2. The modulating signal shall have a nominal frequency of 1 700 Hz and a frequency shift of ±400 Hz with a modulation rate of 1 200 baud.
Standard test signals shall consist of a series of identical call sequences, each of which contain a known number of information symbols Standard test signals shall be of sufficient length for the measurements to be performed or it shall be possible to repeat them without interruption to make the measurements.

4.10.3 TEST PROCEDURE

ETSI EN 301 025-1Sub-clause 10.2.2 :

The two input signals shall be connected to the receiver input terminal via a combining network (see clause 6.1). The wanted signal shall be the DSC standard test signal containing DSC calls. The level of the wanted signal shall be +3 dBµV. The unwanted signal shall be modulated by 400 Hz with a deviation of ±3 kHz. Both input signals shall be at the nominal frequency of the receiver under test and the measurement shall be repeated for displacements of the unwanted signal of up to ±3 kHz.
The input level of the unwanted signal shall be -5 dBµV..

4.10.4 LIMIT

The bit error ratio shall be equal to or less than 10^{-2}..

4.10.5 Test result

Op 3 = 25 KHz RX				
Test Frequency (MHz)	Measurement Offset (KHz)	SG B – SG A (dB)	Limit	Result
B+Y- state	-3	0.0084	$\leqslant 10^{-2}$	Pass
	0	0.0084		
	3	0.0084		

4.10.6 Result

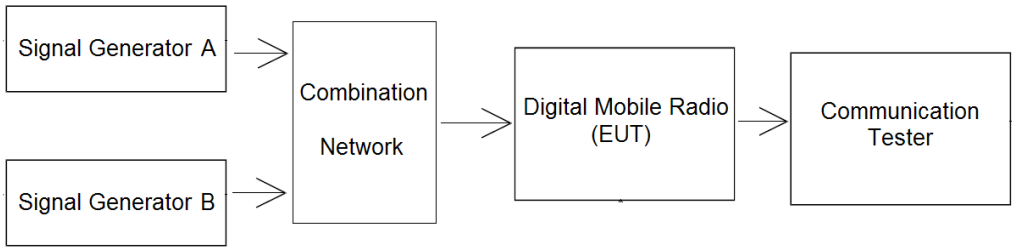
The equipment met the requirement of this clause.

4.11 Receiver DSC spurious response and blocking immunity

4.11.1 Definition

The modulation rate is the bit stream speed measured in bit/s....

4.11.2 TEST CONFIGURATION / SIGNAL



Standard test signals for DSC = The standard test signal for a VHF DSC decoder shall be a phase-modulated signal at VHF channel 70 with modulation index = 2. The modulating signal shall have a nominal frequency of 1 700 Hz and a frequency shift of ±400 Hz with a modulation rate of 1 200 baud.
Standard test signals shall consist of a series of identical call sequences, each of which contain a known number of information symbols Standard test signals shall be of sufficient length for the measurements to be performed or it shall be possible to repeat them without interruption to make the measurements.

4.11.3 TEST PROCEDURE

ETSI EN 301 025-1Sub-clause 8.14.2 :
The two input signals shall be connected to the receiver input terminal via a combining network.
The wanted signal shall be the DSC standard test signal containing DSC calls. The level of the wanted signal shall be +3 dBµV.
For the spurious response test the unwanted signal shall be unmodulated. The frequency shall be varied over the range 9 kHz to 2 GHz with the exception of the channel of the wanted signal and its adjacent channels. The unwanted signal level shall be 73 dBµV. Where spurious response occurs, the bit error ratio shall be determined.
For the blocking test the unwanted signal shall be unmodulated. The frequency shall be varied between -10 MHz and -1 MHz and also between +1 MHz and +10 MHz relative to the nominal frequency of the wanted signal. The unwanted signal shall be at a level of 93 dBµV. Where blocking occurs, the bit error ratio shall be determined.
Bit error rate = total number of incorrect information symbols relative to the total number of information symbols shall be registered.

4.11.4 LIMIT

The bit error ratio shall be equal to or less than 10^{-2}..

4.11.5 Test result

Blocking 25 KHz Rx Ch 70				
Test Frequency (MHz)	Measurement Offset (MHz)	Error rate	Limit error rate	Result
156.525	-10	0	$\leqslant 10^{-2}$	Pass
	-5	0		
	-2	0		
	-1	0		
	1	0		
	2	0		
	5	0		

4.11.6 Result

The equipment met the requirement of this clause.

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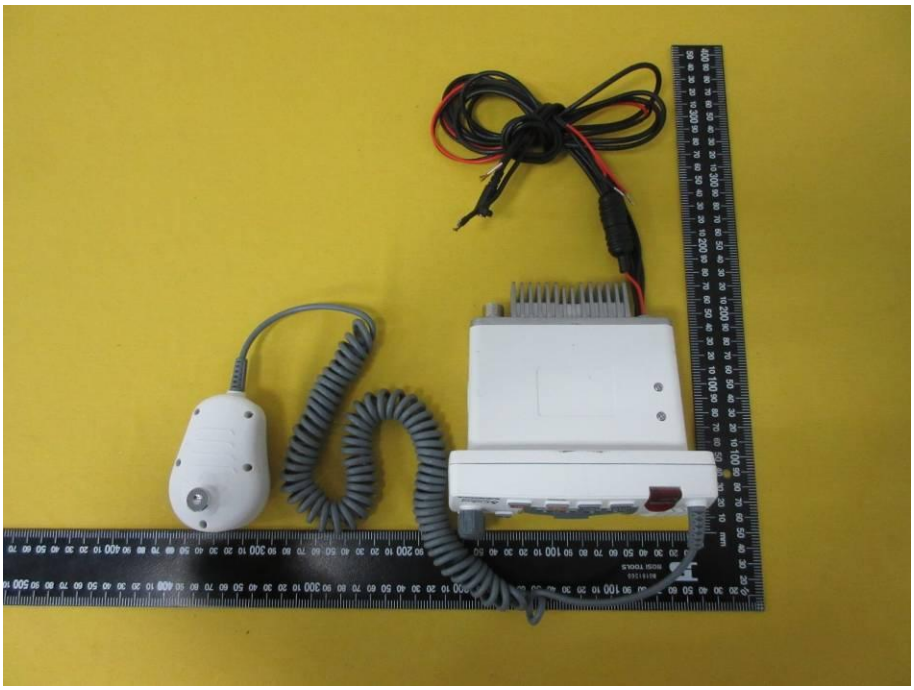
5 Appendix A - Photographs of EUT

MR F77W GPS E



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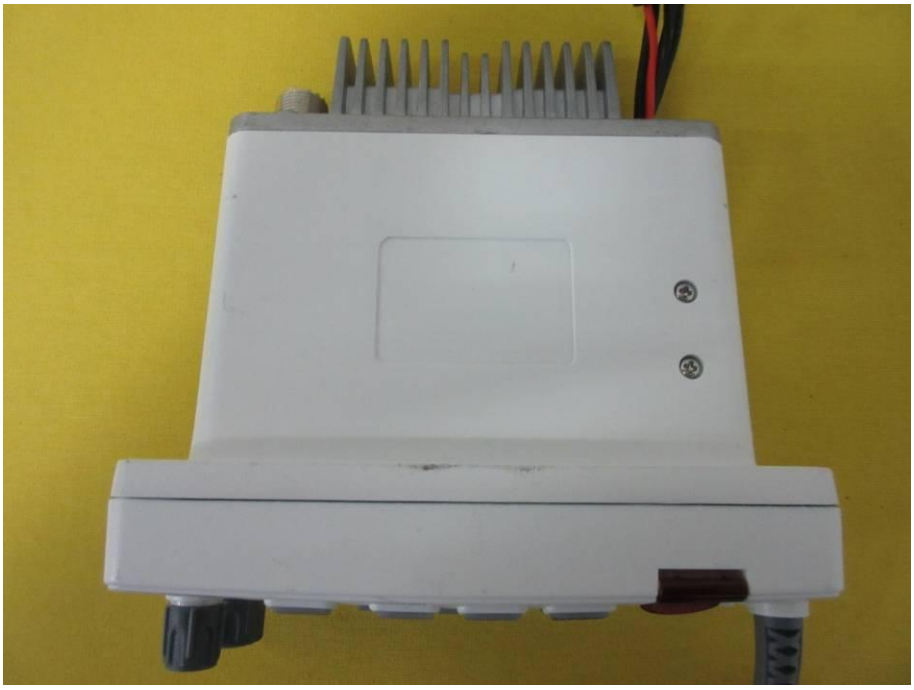

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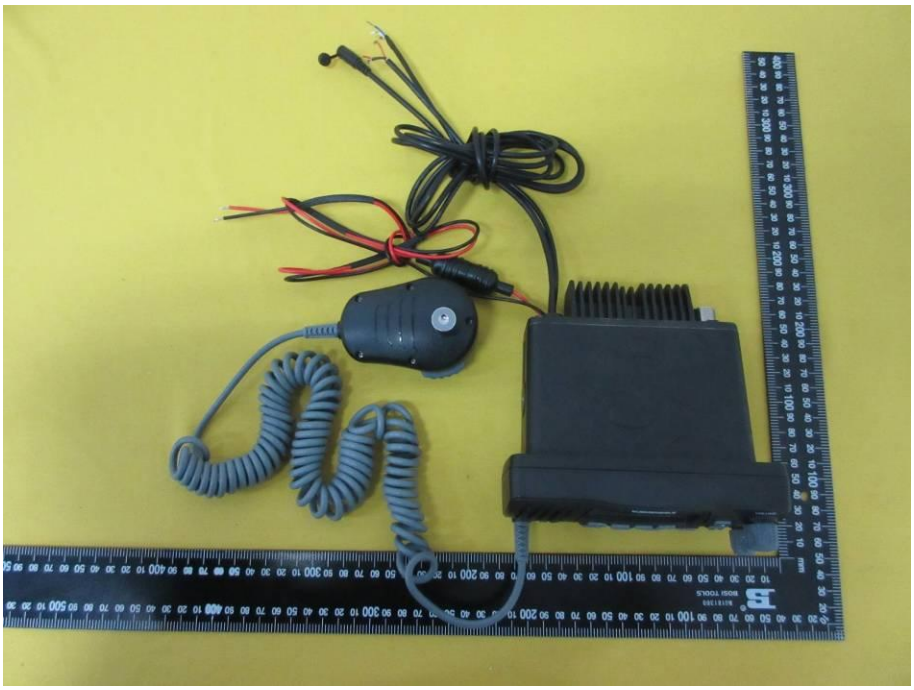
MR F57B E



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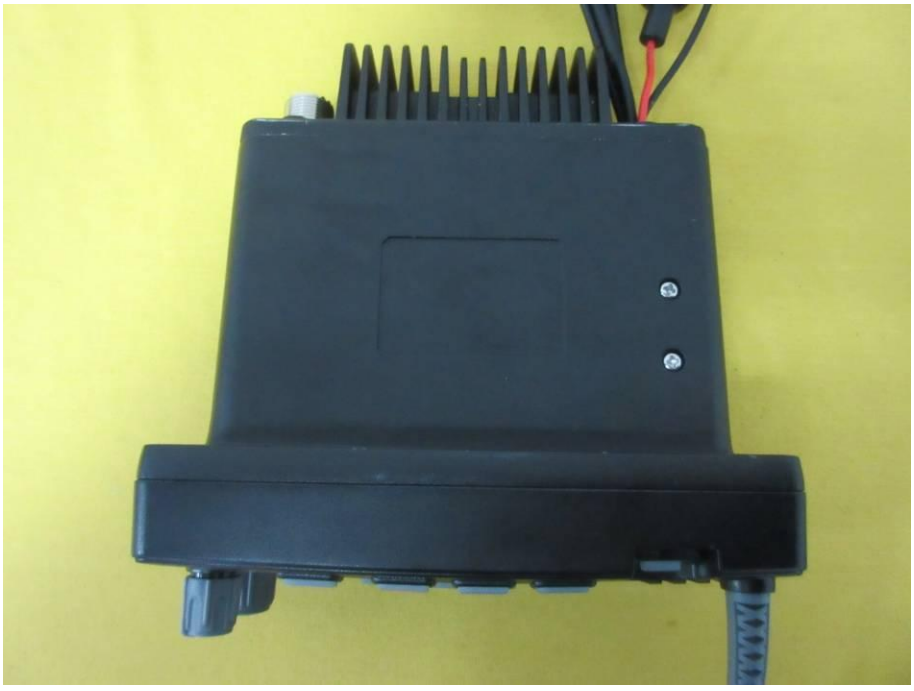

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MR F57W E

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MR F77B GPS E

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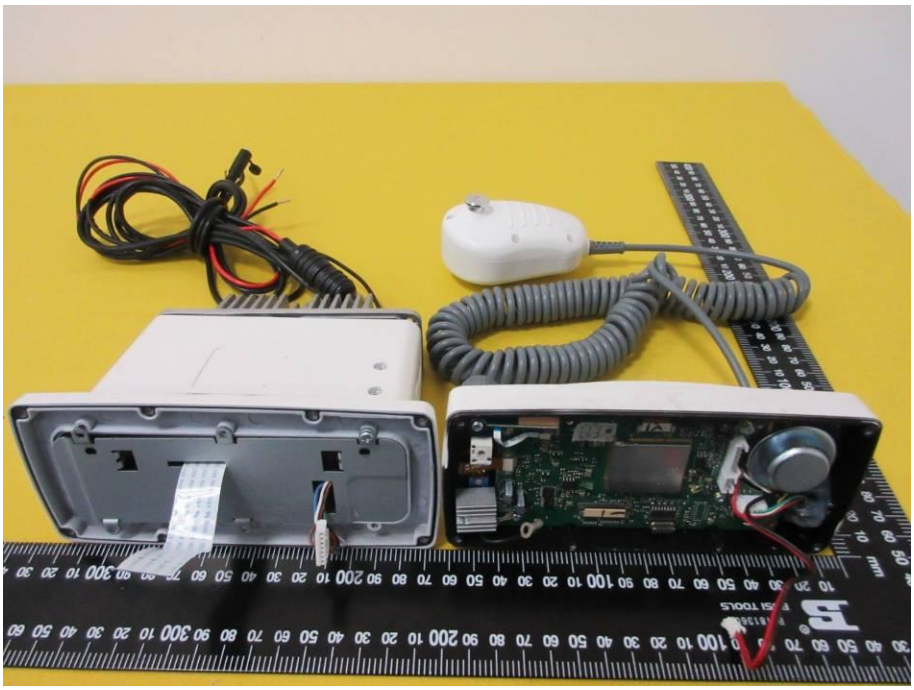
Internal Photos



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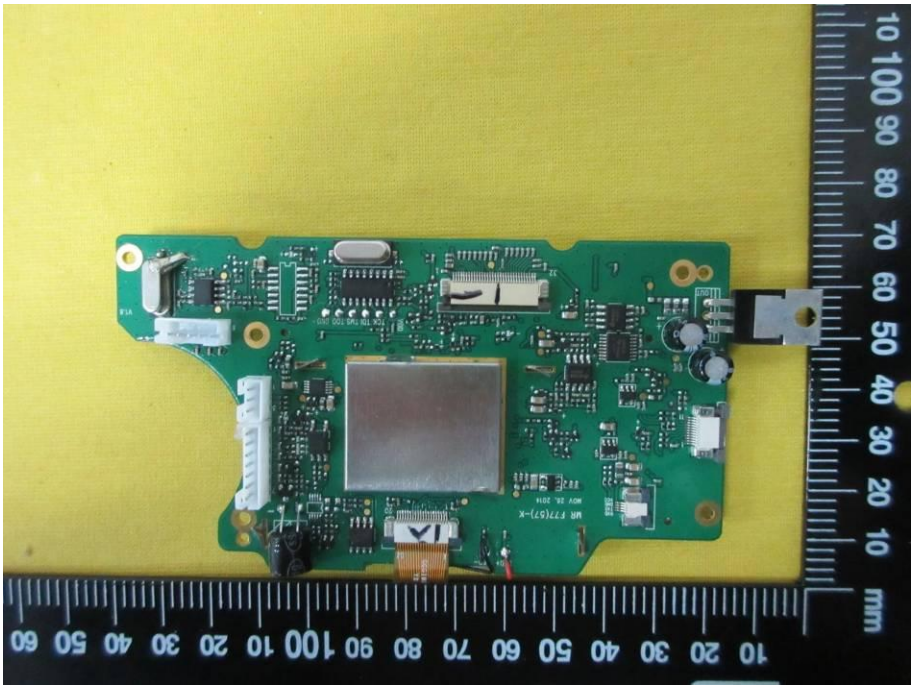

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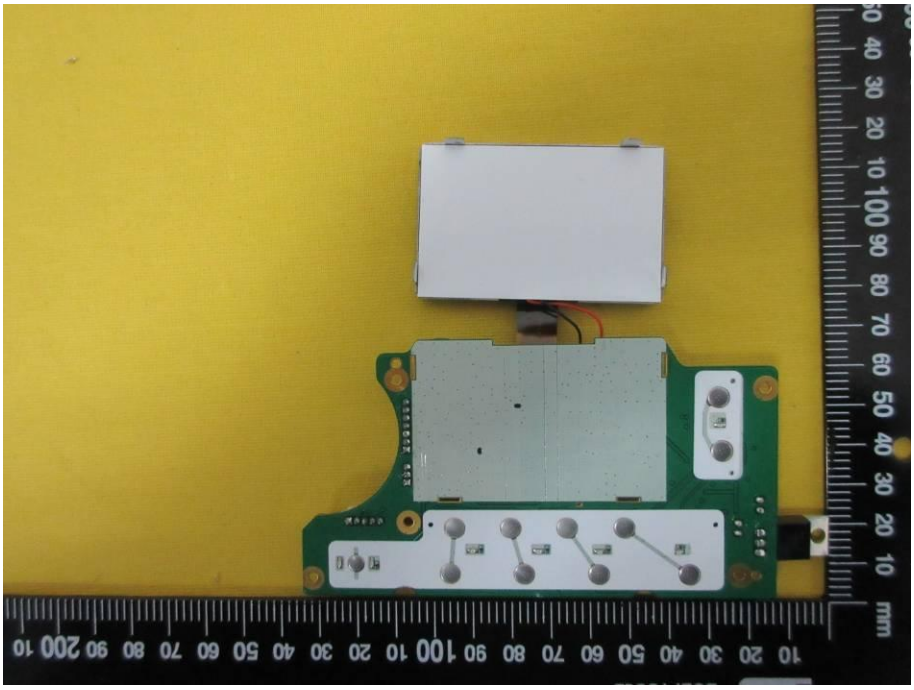

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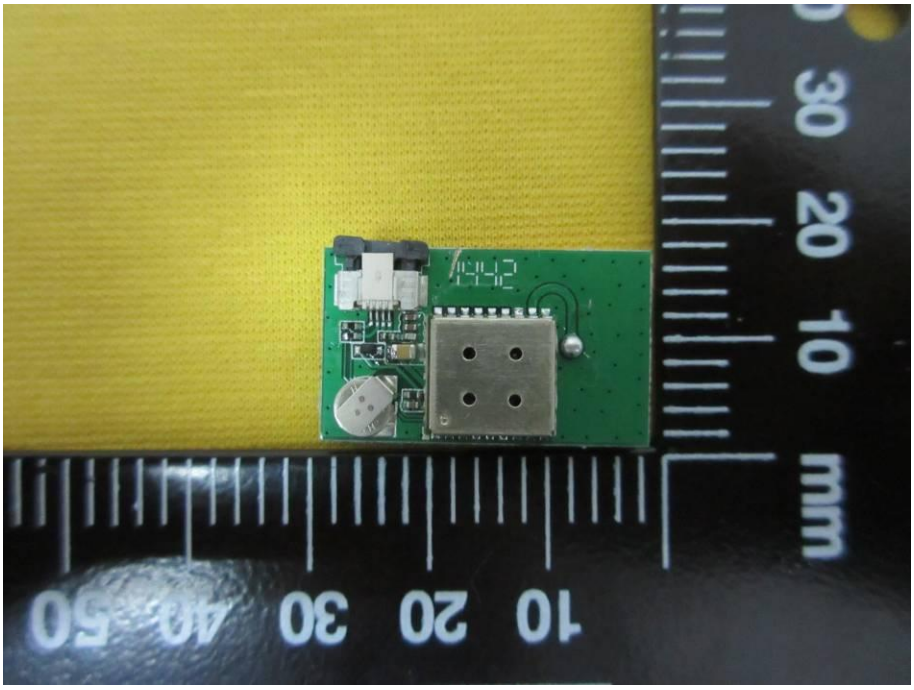

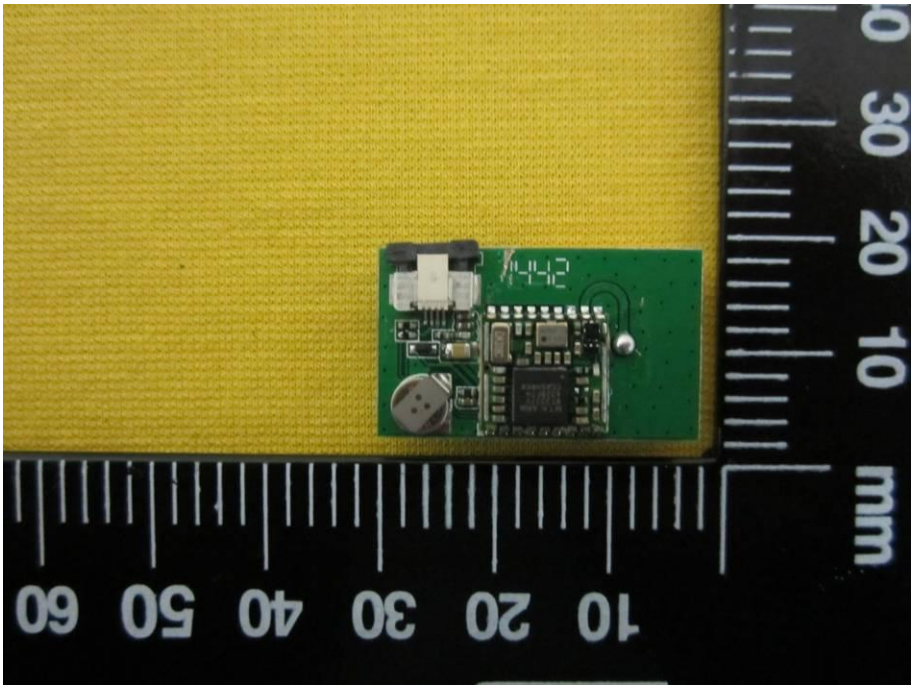

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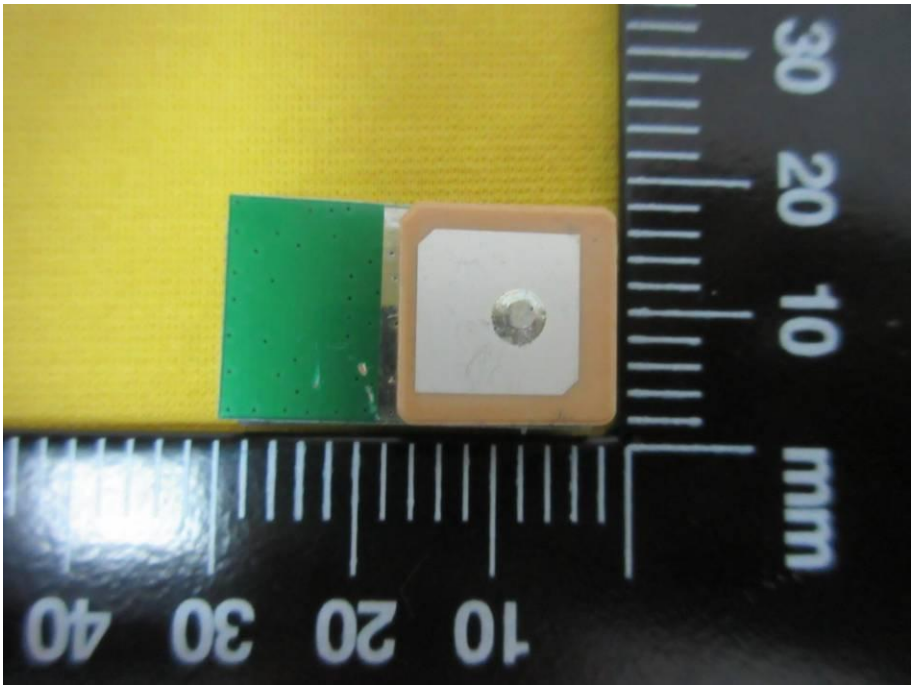
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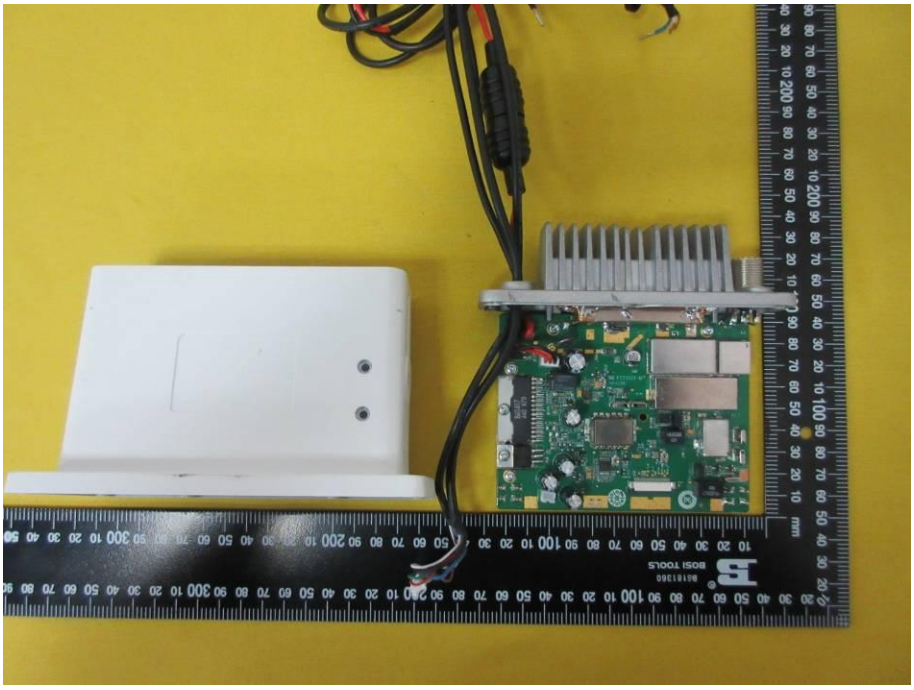

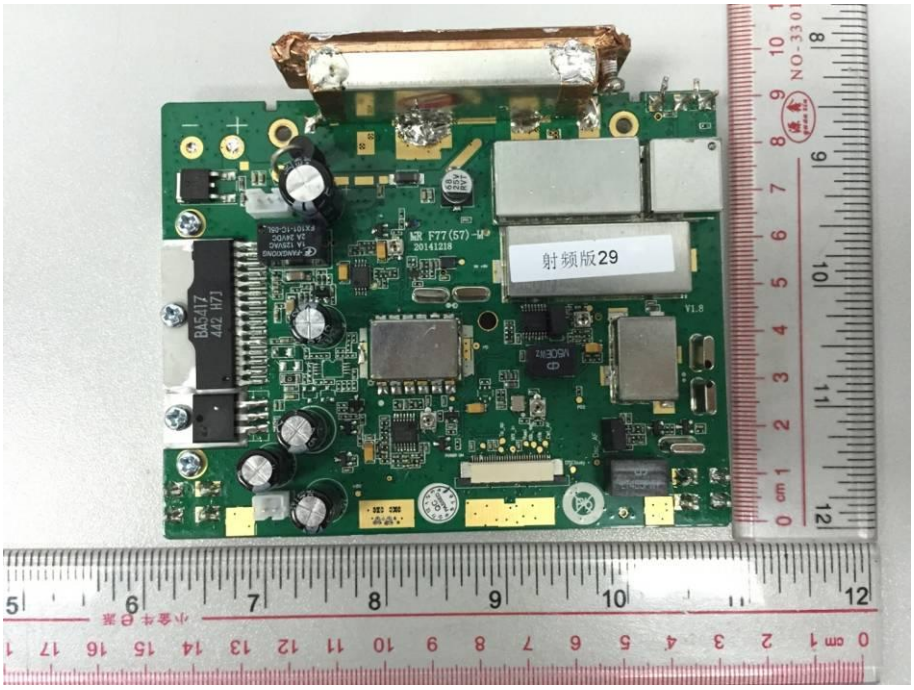

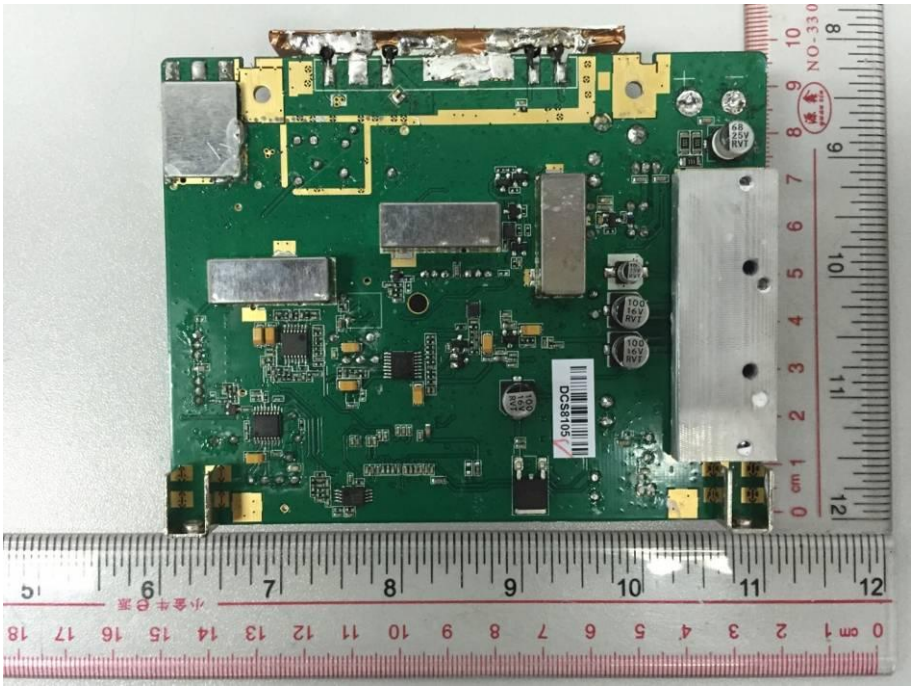

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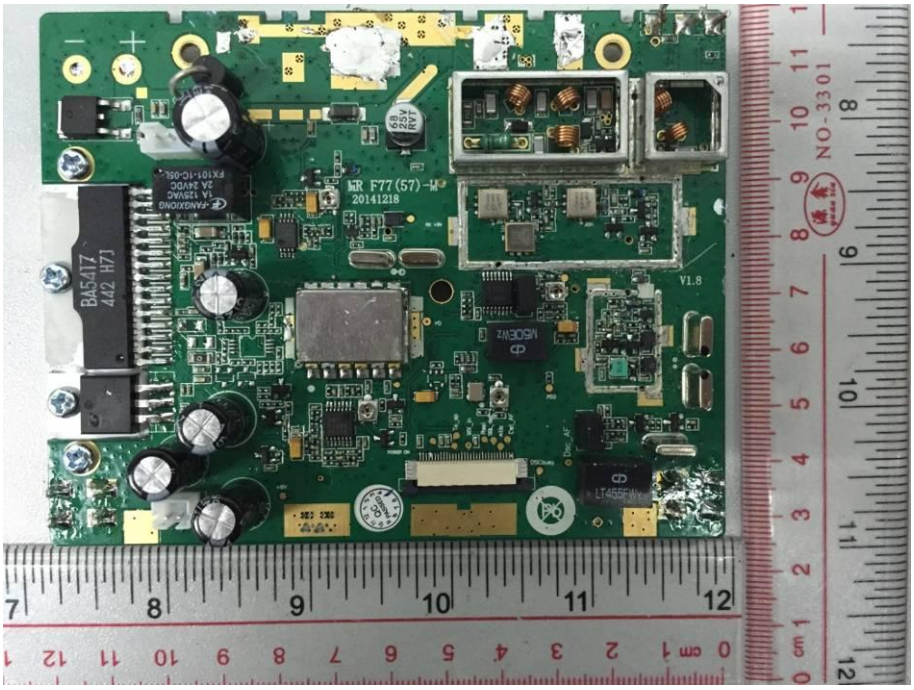

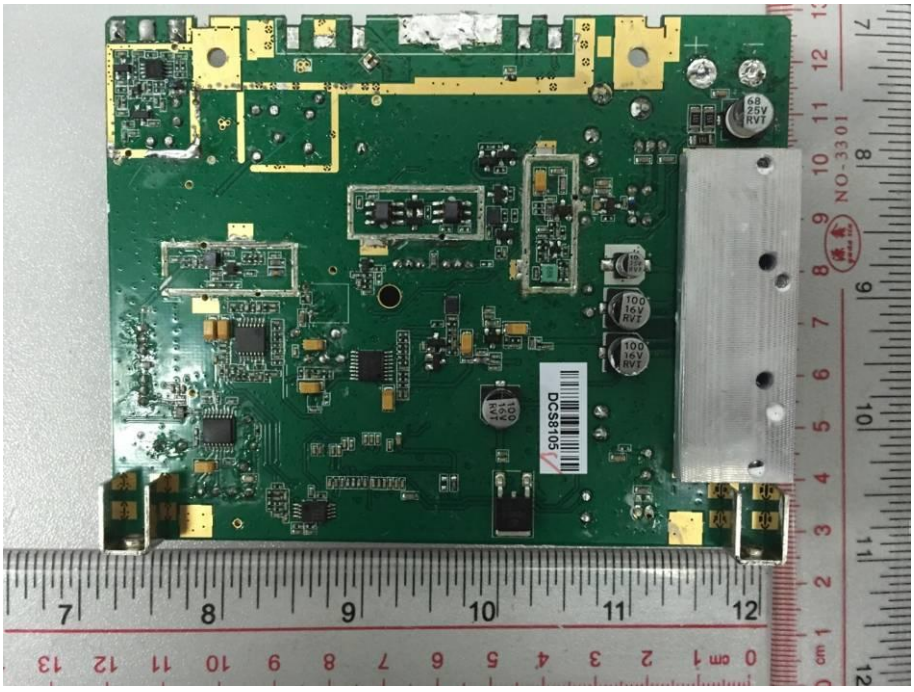

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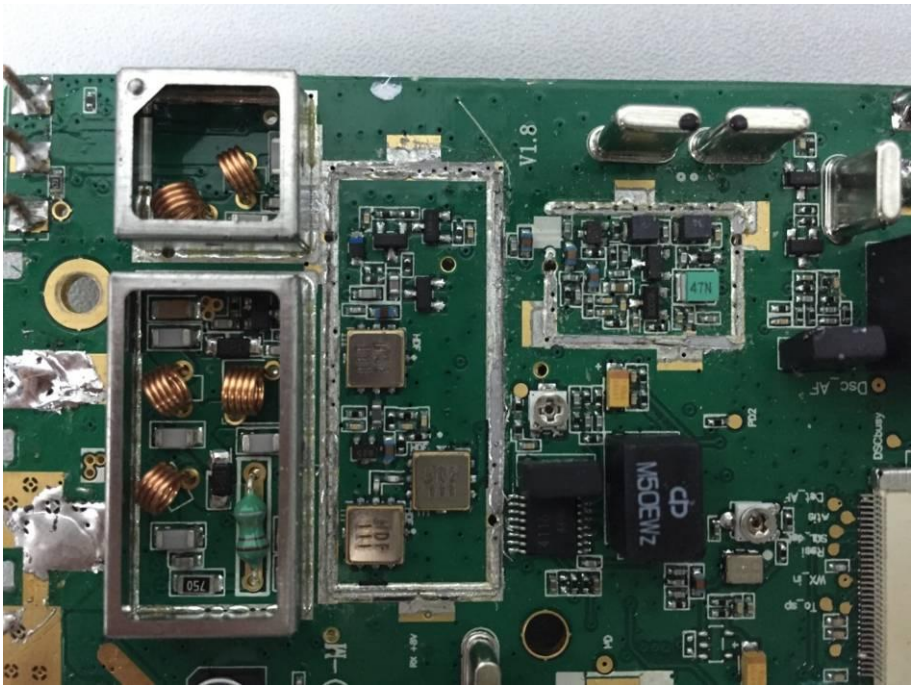

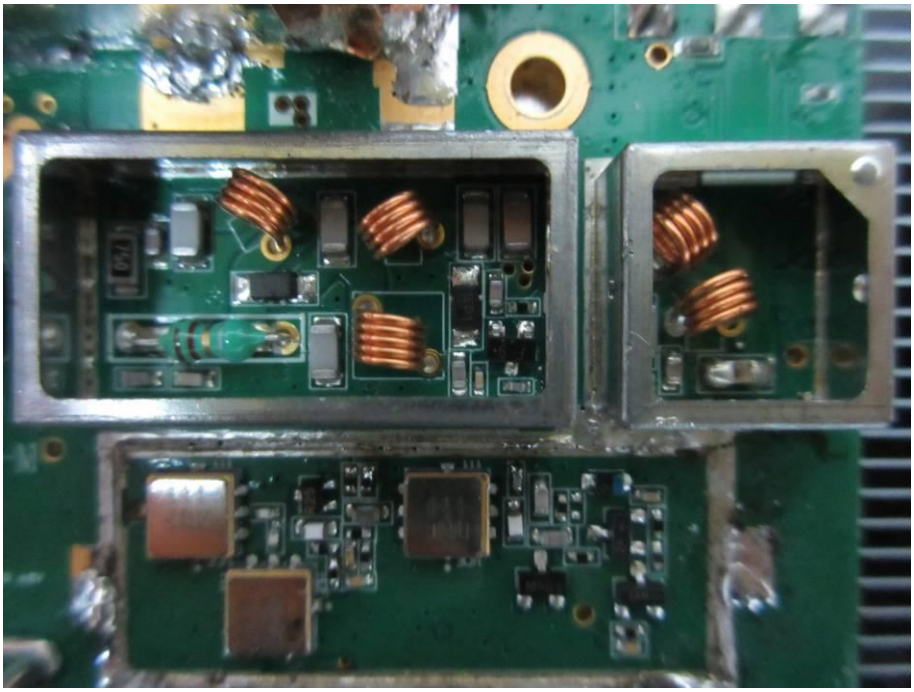

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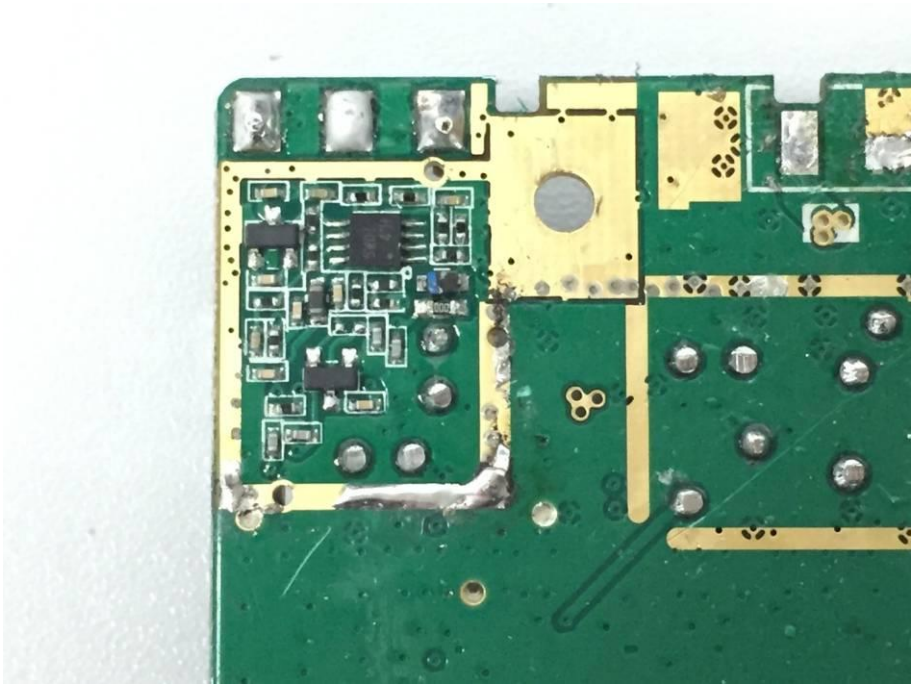

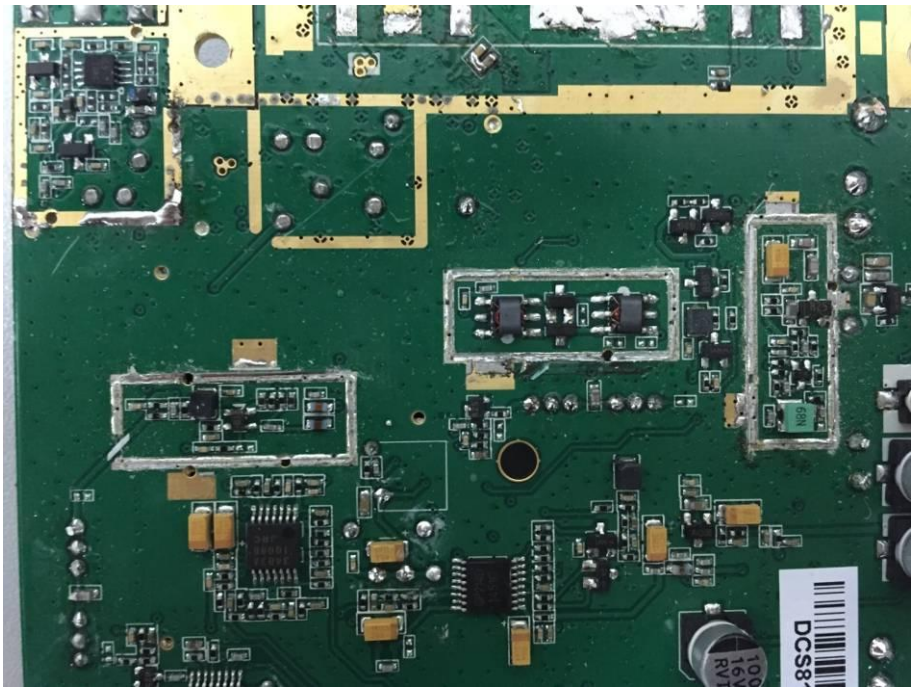

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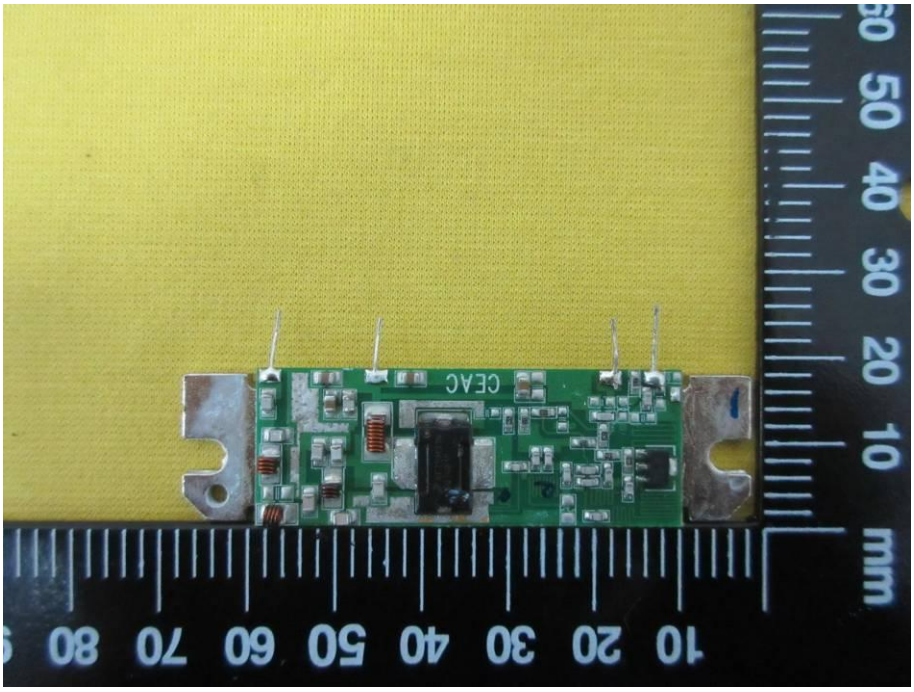

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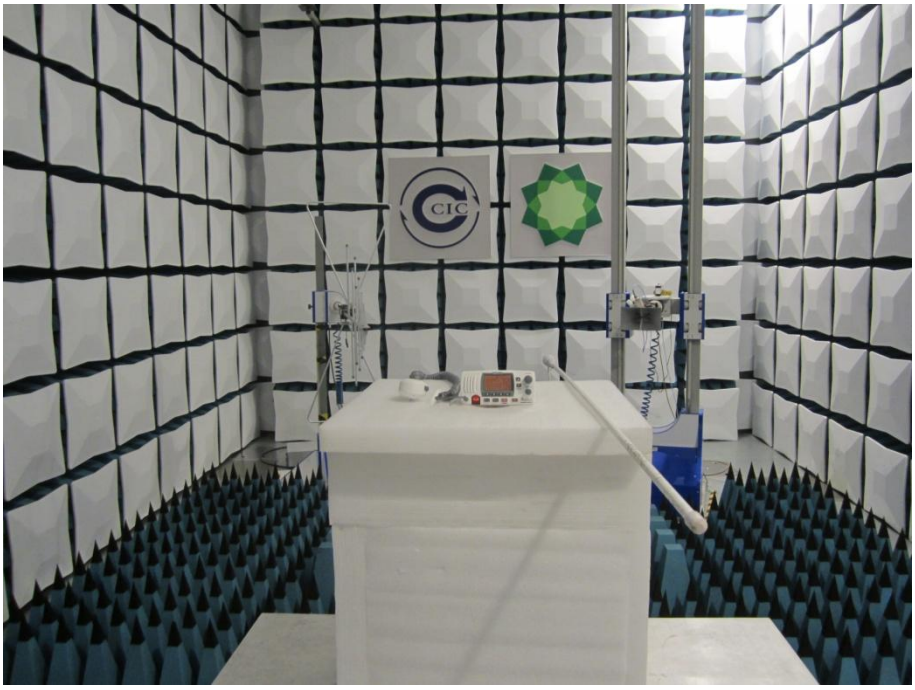
6 Appendix C - Setup Photographs of EUT

6.1 Spurious Emission Setup



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6.2 Conducted Setup

-----The End-----

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