FCC TEST REPORT

For

Guangzhou SOUTH Surveying & Mapping Instrument Co., Ltd.

Digital radio

Test Model: SDL400

Additional Model: /

Prepared for	:	Guangzhou SOUTH Surveying & Mapping Instrument Co., Ltd.
Address	:	Room 301 South Building, No.24-26 Keyun Road, Tian He District, Guangzhou, China
Prepared by	:	Shenzhen LCS Compliance Testing Laboratory Ltd.
Address	:	1/F., Xingyuan Industrial Park, Tongda Road, Bao'an Avenue, Bao'an District, Shenzhen, Guangdong, China
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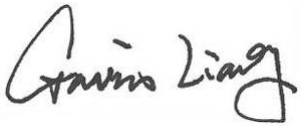
Date of receipt of test sample	:	September 13, 2017
Number of tested samples	:	1
Serial number	:	Prototype
Date of Test	:	September 13, 2017 ~ October 25, 2017
Date of Report	:	October 25, 2017

FCC TEST REPORT FCC Part 90	
Report Reference No.	**: LCS170907016AE3**
Date of Issue	: October 25, 2017
Testing Laboratory Name.....	**: Shenzhen LCS Compliance Testing Laboratory Ltd.**
Address	: 1/F., Xingyuan Industrial Park, Tongda Road, Bao'an Avenue, Bao'an District, Shenzhen, Guangdong, China
Testing Location/ Procedure	: Full application of Harmonised standards ■ Partial application of Harmonised standards □ Other standard testing method □
Applicant's Name	**: Guangzhou SOUTH Surveying & Mapping Instrument Co., Ltd.**
Address	: Room 301 South Building, No.24-26 Keyun Road, Tian He District, Guangzhou, China
Test Specification	
Standard	: FCC Part 90/FCC Part 2/FCC Part 15B
Test Report Form No.	: LCSEMC-1.0
TRF Originator.....	: Shenzhen LCS Compliance Testing Laboratory Ltd.
Master TRF	: Dated 2011-03

Test Item Description.....	**: Digital radio**
Trade Mark	: SOUTH, KOLIDA, SANDING, RUIDE, TIANYU
Test Model.....	: SDL400
Ratings	: DC 7.4V by external power
**Result ……..... **	**: Positive**

Compiled by:	**Supervised by:**	**Approved by:**
		
Aking Jin/ File administrators	Dick Su/ Technique principal	Gavin Liang/ Manager

RADIO -- TEST REPORT

Test Report No. : LCS170907016AE3	October 25, 2017 Date of issue

Test Model.....	:	SDL400
EUT.....	:	Digital radio
Applicant.....	**:**	**Guangzhou SOUTH Surveying & Mapping Instrument Co., Ltd.**
Address.....	:	Room 301 South Building, No.24-26 Keyun Road, Tian He District, Guangzhou, China
Telephone.....	:	/
Fax.....	:	/
Manufacturer.....	**:**	**Guangzhou SOUTH Surveying & Mapping Instrument Co., Ltd.**
Address.....	:	Room 301 South Building, No.24-26 Keyun Road, Tian He District, Guangzhou, China
Telephone.....	:	/
Fax.....	:	/
Factory.....	**:**	**Guangzhou SOUTH Surveying & Mapping Instrument Co., Ltd.**
Address.....	:	Room 301 South Building, No.24-26 Keyun Road, Tian He District, Guangzhou, China
Telephone.....	:	/
Fax.....	:	/

Test Result	**Positive**

The test report merely corresponds to the test sample.

It is not permitted to copy extracts of these test result without the written permission of the test laboratory.

Revision History

Revision	Issue Date	Revisions	Revised By
00	October 25, 2017	Initial Issue	Gavin Liang

TABLE OF CONTENTS

Test Report Description Page

1. GENERAL INFORMATION

1.1. Product Description for Equipment Under Test (EUT)

EUT	: Digital radio
Test Model	: SDL400
Additional Model	: -/-
Model Declaration	: -/-
Power Supply	: DC 7.4V by external power
Hardware Version	: 1.2
Software Version	: 20170418
Frequency Range	: 410 MHz – 470 MHz
Channel Separation	: 12.5 KHz & 25 KHz
RF Rated Output Power	: 3Watts/1Watts
Emission Designator	: 7K65G1D for GMSK Modulation at 12.5KHz Channel Separation 15K9G1D for GMSK Modulation at 25KHz Channel Separation
Antenna Description	: External, Antenna Gain from 0 dBi to 10 dBi

1.2. Objective

The tests were performed according to following standards:

FCC Rules Part 90: 2015: PRIVATE LAND MOBILE RADIO SERVICES.
47 CFR FCC Part 15 Subpart B: 2015 - Unintentional Radiators
FCC Part 2: FREQUENCY ALLOCA-TIONS AND RADIO TREATY MAT-TERS; GENERAL RULES AND REG-ULATIONS
ANSI C63.26:2015: American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services.

1.3. Related Submittal(s)/Grant(s)

No Related Submittals.

1.4. Description of Test Facility

CNAS Registration Number. is L4595.
FCC Registration Number. is CN5024.
Industry Canada Registration Number. is 9642A-1.
ESMD Registration Number. is ARCB0108.
UL Registration Number. is 100571-492.
TUV SUD Registration Number. is SCN1081.
TUV RH Registration Number. is UA 50296516-001.
NVLAP Registration Code is 600167-0.
The 3m-Semi anechoic test site fulfils CISPR 16-1-4 according to ANSI C63.4:2014 and CISPR 16-1-4:2010 SVSWR requirement for radiated emission above 1GHz.

1.5. Support equipment List

Manufacturer	Description	Model	Serial Number	Certificate
MEAN WELL ENTERPRISES CO LTD	Power Adapter	GS18B12	--	VoC

1.6. External I/O

I/O Port Description	Quantity	Cable
--	--	--

1.7. Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

Test Item		Frequency Range	Uncertainty	Note
Radiation Uncertainty	:	9KHz~30MHz	3.10dB	(1)
		30MHz~200MHz	2.96dB	(1)
		200MHz~1000MHz	3.10dB	(1)
		1GHz~26.5GHz	3.80dB	(1)
		26.5GHz~40GHz	3.90dB	(1)
Conduction Uncertainty	:	150kHz~30MHz	1.63dB	(1)
Power disturbance	:	30MHz~300MHz	1.60dB	(1)

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

1.8. Test Environment

Items	Required (IEC 68-1)	Actual
Temperature (°C)	15-35	21
Humidity (%RH)	25-75	50
Barometric pressure (mbar)	860-1060	950-1000

1.9. Description Of Test Modes

The EUT has been tested under typical operating condition and The Transmitter was operated in the normal operating mode. The TX frequency was fixed which was for the purpose of the measurements.

EUT operation mode no.	Description of operation mode	Additional information
Op 1	GMSK+BW12.5KHz+TX	The equipment is set with GMSK modulation and 12.5KHz bandwidth at maximum rated power for transmitter, powered by DC 7.40V power adapter from AC 120V/60Hz
Op 2	GMSK+BW12.5KHz+TX	The equipment is set with GMSK modulation and 12.5KHz bandwidth at minimum rated power for transmitter, powered by DC 7.40V power adapter from AC 120V/60Hz
Op 3	GMSK+BW25KHz+TX	The equipment is set with GMSK modulation and 25KHz bandwidth at maximum rated power for transmitter, powered by DC 7.40V power adapter from AC 120V/60Hz
Op 4	GMSK+BW25KHz+TX	The equipment is set with GMSK modulation and 25KHz bandwidth at minimum rated power for transmitter, powered by DC 7.40V power adapter from AC 120V/60Hz
Op 5	GMSK+BW12.5KHz+TX	The equipment is set with GMSK modulation and 12.5KHz bandwidth at maximum rated power for transmitter, powered by DC 7.40V power adapter from AC 240V/50Hz
Op 6	GMSK+BW25KHz+TX	The equipment is set with GMSK modulation and 25KHz bandwidth at maximum rated power for transmitter, powered by DC 7.40V power adapter from AC 240V/50Hz
Op 7	GMSK+BW12.5KHz+TX	The equipment is set with GMSK modulation and 12.5KHz bandwidth at maximum rated power for transmitter, powered by DC 7.40V
Op 8	GMSK+BW12.5KHz+TX	The equipment is set with GMSK modulation and 12.5KHz bandwidth at minimum rated power for transmitter, powered by DC 7.40V
Op 9	GMSK+BW25KHz+TX	The equipment is set with GMSK modulation and 25KHz bandwidth at maximum rated power for transmitter, powered by DC 7.40V
Op 10	GMSK+BW25KHz+TX	The equipment is set with GMSK modulation and 25KHz bandwidth at minimum rated power for transmitter, powered by DC 7.40V

Test frequency list

Modulation Type	Channel Separation	Test Channel	Test Frequency (MHz)
GMSK	12.5KHz	Ch1	410.125
		Ch2	465.125
		Ch3	469.975
	25KHz	Ch4	410.250
		Ch5	456.250
		Ch6	469.850

2. SYSTEM TEST CONFIGURATION

2.1. Justification

The system was configured for testing in engineering mode.

2.2. EUT Exercise Software

The system was configured for testing in continuous transmits condition and change test channels by software (tool TestSerial) provided by application.

2.3. Special Accessories

No.	Equipment	Manufacturer	Model No.	Serial No.	Length	shielded/ unshielded	Notes
1	PC	Lenovo	Ideapad	A131101550	/	/	DOC
2	Power adapter	Lenovo	CPA-A090	36200414	1.00m	unshielded	DOC

2.4. Block Diagram/Schematics

Please refer to the related document.

2.5. Equipment Modifications

Shenzhen LCS Compliance Testing Laboratory Ltd. has not done any modification on the EUT.

2.6. Configuration of Test Setup

Please refer to the test setup photo.

3. SUMMARY OF TEST RESULT

Test specification clause	Test case	Verdict
FCC Part 15.207	Conducted Emission	PASS
FCC Part 90.205	Maximum Transmitter Power	PASS
FCC Part 90.207 / FCC Part 2.1047 (a)	Modulation Characteristics - Audio Frequency Response	N/A*
FCC Part 90.207 / FCC Part 2.1047 (b)	Modulation Characteristics - Modulation Limiting	PASS
FCC Part 90.209	Occupied Bandwidth	PASS
FCC Part 90.210	Emission Mask	PASS
FCC Part 90.213	Frequency Stability	PASS
FCC Part 90.214	Transmitter Frequency Behavior	PASS
FCC Part 90.210	Transmitter Radiated Spurious Emission	PASS
FCC Part 90.210	Spurious Emission On Antenna Port	PASS

Remark:

1. The measurement uncertainty is not included in the test result.

2. N/A - Not Applicable for this device.*

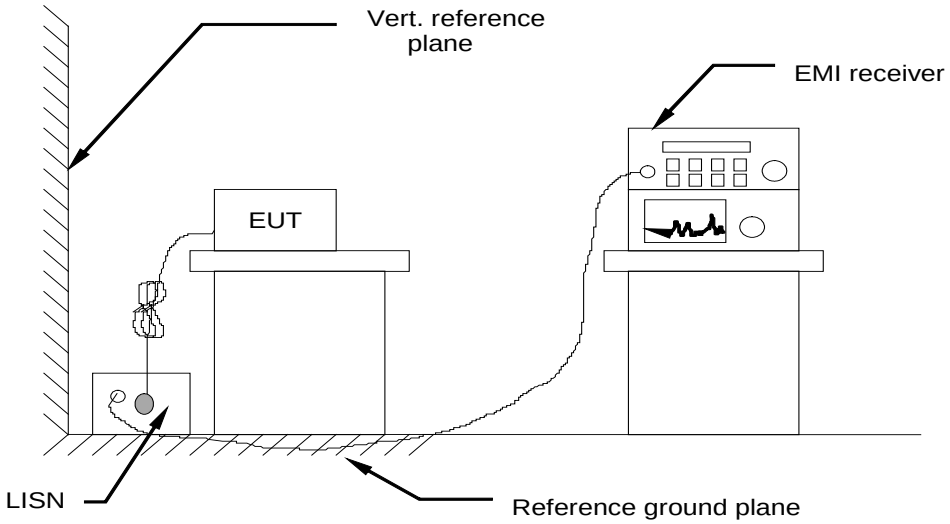
4. TEST CONDITIONS AND RESULTS

4.1. Conducted Emissions Test

4.1.1. TEST APPLICABLE

The EUT was tested according to ANSI C63.4 - 2014. The frequency spectrum from 0.15 MHz to 30 MHz was investigated. The LISN used was 50 ohm / 50 u Henry as specified by section 5.1 of ANSI C63.4 - 2014. Cables and peripherals were moved to find the maximum emission levels for each frequency.

4.1.2. TEST CONFIGURATION



4.1.3. TEST PROCEDURE

1 The equipment was set up as per the test configuration to simulate typical actual usage per the user's manual. The EUT is a tabletop system; a wooden table with a height of 0.8 meters is used and is placed on the ground plane as per ANSI C63.4-2014.
2 Support equipment, if needed, was placed as per ANSI C63.4-2014.
3 All I/O cables were positioned to simulate typical actual usage as per ANSI C63.4-2014.
4 If a EUT received AC120V/60Hz power through a Line Impedance Stabilization Network (LISN) which supplied power source and was grounded to the ground plane.
5 All support equipment received AC power from a second LISN, if any.
6 The EUT test program was started. Emissions were measured on each current carrying line of the EUT using a spectrum Analyser / Receiver connected to the LISN powering the EUT. The LISN has two monitoring points: Line 1 (Hot Side) and Line 2 (Neutral Side). Two scans were taken: one with Line 1 connected to Analyser / Receiver and Line 2 connected to a 50 ohm load; the second scan had Line 1 connected to a 50 ohm load and Line 2 connected to the Analyser / Receiver.
7 Analyser / Receiver scanned from 150 KHz to 30MHz for emissions in each of the test modes.
8 During the above scans, the emissions were maximized by cable manipulation.

Conducted Power Line Emission Limit

For intentional device, according to § 15.207(a) and RSS-Gen Section 7.2.4 for AC Power Conducted Emission Limits is as following:

Frequency (MHz)	Maximum RF Line Voltage (dBμV)			
	CLASS A		CLASS B	
	Q.P.	Ave.	Q.P.	Ave.
0.15 - 0.50	79	66	66-56*	56-46*
0.50 - 5.00	73	60	56	46
5.00 - 30.0	73	60	60	50

* Decreasing linearly with the logarithm of the frequency

4.1.4. TEST RESULTS

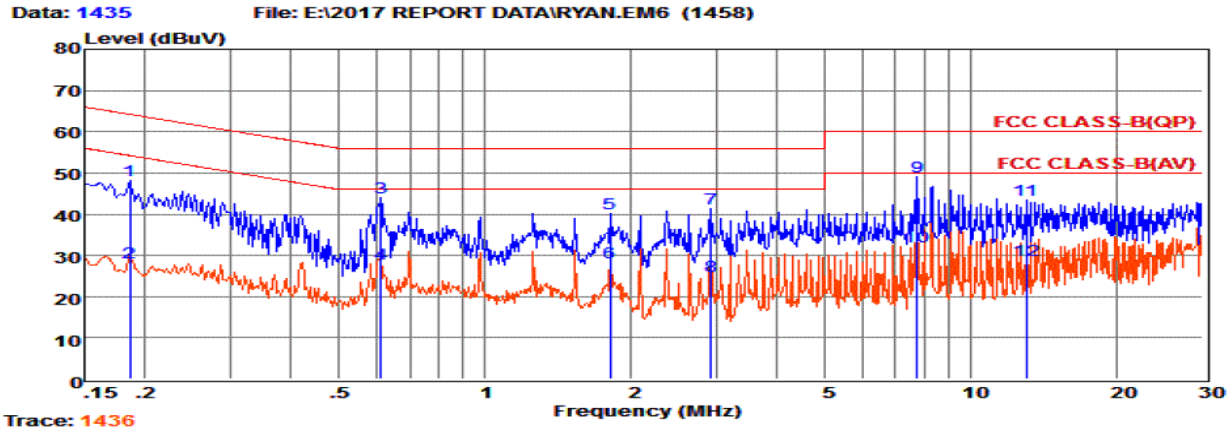
PASS

1. Measured at Op 1 to Op 6, recorded worst case at Op 1 and Op 5.

2. Please refer to next page for test plots.

AC Mains Conducted Emission @ AC 240V/50Hz

Line

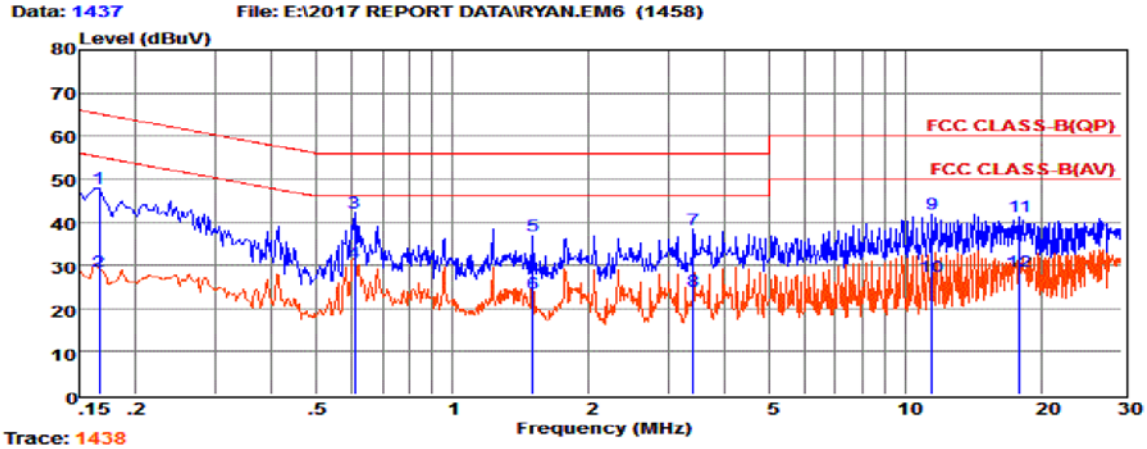


Trace: 1436
Power Rating: AC 240V/50Hz
Pol: LINE

	Freq	Reading	LISNFac	CabLos	Aux2Fac	Measured	Limit	Over	Remark
	MHz	dBuV	dB	dB	dB	dB	dBuV	dBuV	dB
1	0.19	28.43	9.62	0.02	10.00	48.07	64.20	-16.13	QP
2	0.19	8.72	9.62	0.02	10.00	28.36	54.19	-25.83	Average
3	0.61	24.41	9.63	0.04	10.00	44.08	56.00	-11.92	QP
4	0.61	8.40	9.63	0.04	10.00	28.07	46.00	-17.93	Average
5	1.81	20.61	9.64	0.05	10.00	40.30	56.00	-15.70	QP
6	1.81	8.59	9.64	0.05	10.00	28.28	46.00	-17.72	Average
7	2.92	21.62	9.64	0.06	10.00	41.32	56.00	-14.68	QP
8	2.92	5.28	9.64	0.06	10.00	24.98	46.00	-21.02	Average
9	7.77	29.33	9.68	0.07	10.00	49.08	60.00	-10.92	QP
10	7.77	12.51	9.68	0.07	10.00	32.26	50.00	-17.74	Average
11	12.99	23.69	9.70	0.09	10.00	43.48	60.00	-16.52	QP
12	12.99	9.13	9.70	0.09	10.00	28.92	50.00	-21.08	Average

Remarks: 1. Measured = Reading + LISNFac + Cable Loss + Aux2 Fac.
2. The emission levels that are 20dB below the official limit are not reported.

Neutral



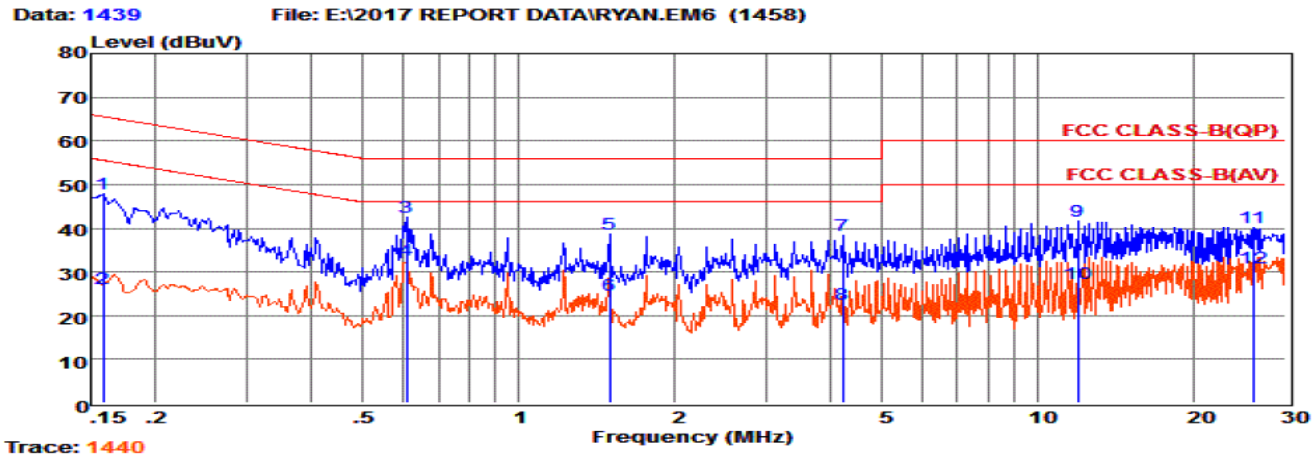
Trace: 1438
Power Rating: AC 240V/50Hz
Pol: NEUTRAL

	Freq	Reading	LISNFac	CabLos	Aux2Fac	Measured	Limit	Over	Remark
	MHz	dBuV	dB	dB	dB	dB	dBuV	dBuV	dB
1	0.17	28.28	9.66	0.02	10.00	47.96	65.16	-17.20	QP
2	0.17	9.01	9.66	0.02	10.00	28.69	55.16	-26.47	Average
3	0.61	22.68	9.63	0.04	10.00	42.35	56.00	-13.65	QP
4	0.61	10.85	9.63	0.04	10.00	30.52	46.00	-15.48	Average
5	1.50	17.30	9.63	0.05	10.00	36.98	56.00	-19.02	QP
6	1.50	3.73	9.63	0.05	10.00	23.41	46.00	-22.59	Average
7	3.40	18.71	9.65	0.06	10.00	38.42	56.00	-17.58	QP
8	3.40	4.50	9.65	0.06	10.00	24.21	46.00	-21.79	Average
9	11.44	22.17	9.73	0.09	10.00	41.99	60.00	-18.01	QP
10	11.44	7.40	9.73	0.09	10.00	27.22	50.00	-22.78	Average
11	17.85	21.33	9.80	0.11	10.00	41.24	60.00	-18.76	QP
12	17.85	8.74	9.80	0.11	10.00	28.65	50.00	-21.35	Average

Remarks: 1. Measured = Reading + LISNFac + Cable Loss + Aux2 Fac.
2. The emission levels that are 20dB below the official limit are not reported.

AC Mains Conducted Emission @ AC 120V/60Hz

Line

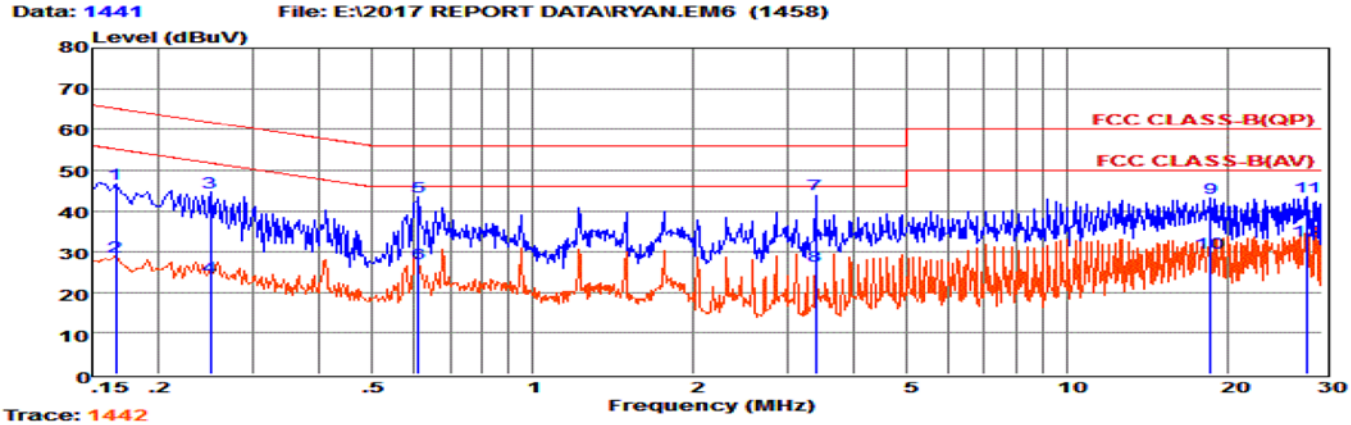


Trace: 1440
Power Rating: AC 120V/60Hz
Pol: NEUTRAL

	Freq	Reading	LISNFac	CabLos	Aux2Fac	Measured	Limit	Over	Remark
	MHz	dBuV	dB	dB	dB	dB	dBuV	dBuV	dB
1	0.16	28.18	9.68	0.02	10.00	47.88	65.56	-17.68	QP
2	0.16	6.48	9.68	0.02	10.00	26.18	55.55	-29.37	Average
3	0.61	22.73	9.63	0.04	10.00	42.40	56.00	-13.60	QP
4	0.61	13.13	9.63	0.04	10.00	32.80	46.00	-13.20	Average
5	1.50	18.87	9.63	0.05	10.00	38.55	56.00	-17.45	QP
6	1.50	5.00	9.63	0.05	10.00	24.68	46.00	-21.32	Average
7	4.20	18.51	9.65	0.06	10.00	38.22	56.00	-17.78	QP
8	4.20	2.86	9.65	0.06	10.00	22.57	46.00	-23.43	Average
9	11.93	21.73	9.73	0.09	10.00	41.55	60.00	-18.45	QP
10	11.93	7.52	9.73	0.09	10.00	27.34	50.00	-22.66	Average
11	26.00	20.31	9.83	0.13	10.00	40.27	60.00	-19.73	QP
12	26.00	11.04	9.83	0.13	10.00	31.00	50.00	-19.00	Average

Remarks: 1. Measured = Reading + LISNFac + Cable Loss + Aux2 Fac.
2. The emission levels that are 20dB below the official limit are not reported.

Neutral



Trace: 1442
Power Rating: AC 120V/60Hz
Pol: LINE

	Freq	Reading	LISNFac	CabLos	Aux2Fac	Measured	Limit	Over	Remark
	MHz	dBuV	dB	dB	dB	dB	dBuV	dBuV	dB
1	0.17	27.11	9.59	0.02	10.00	46.72	65.16	-18.44	QP
2	0.17	9.14	9.59	0.02	10.00	28.75	55.16	-26.41	Average
3	0.25	24.84	9.63	0.03	10.00	44.50	61.78	-17.28	QP
4	0.25	4.18	9.63	0.03	10.00	23.84	51.77	-27.93	Average
5	0.61	23.67	9.63	0.04	10.00	43.34	56.00	-12.66	QP
6	0.61	7.45	9.63	0.04	10.00	27.12	46.00	-18.88	Average
7	3.38	24.16	9.65	0.06	10.00	43.87	56.00	-12.13	QP
8	3.38	6.65	9.65	0.06	10.00	26.36	46.00	-19.64	Average
9	18.52	23.34	9.75	0.11	10.00	43.20	60.00	-16.80	QP
10	18.52	9.84	9.75	0.11	10.00	29.70	50.00	-20.30	Average
11	28.15	23.55	9.71	0.14	10.00	43.40	60.00	-16.60	QP
12	28.15	12.89	9.71	0.14	10.00	32.74	50.00	-17.26	Average

Remarks: 1. Measured = Reading + LISNFac + Cable Loss + Aux2 Fac.
2. The emission levels that are 20dB below the official limit are not reported.

4.2. Occupied Bandwidth and Emission Mask Test

4.2.1. TEST APPLICABLE

(a). Occupied Bandwidth: The EUT was connected to the audio signal generator and the spectrum analyser via the main RF connector, and through an appropriate attenuator. The EUT was controlled to transmit its maximum power. Then the bandwidth of 99% power can be measured by the spectrum analyser.

(b). Emission Mask B: For transmitters that are equipped with an audio low-pass filter pursuant to §90.211(a), the power of any emission must be below the unmodulated carrier power (P) as follows:

(1) On any frequency removed from the assigned frequency by more than 50 percent, but not more than 100 percent of the authorized bandwidth: At least 25 dB.

(2) On any frequency removed from the assigned frequency by more than 100 percent, but not more than 250 percent of the authorized bandwidth: At least 35 dB.

(3) On any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth: At least 43 + 10 log (P) dB.

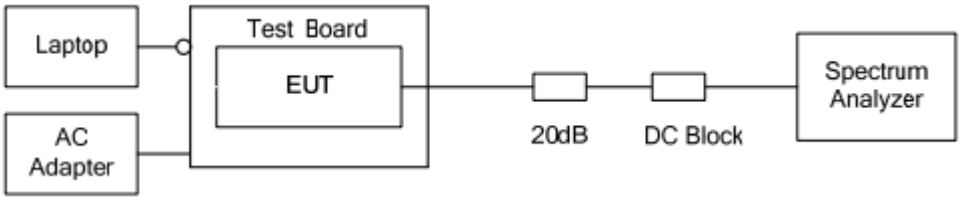
(c). Emission Mask D, 12.5 kHz channel bandwidth equipment: For transmitters designed to operate with a 12.5 kHz channel bandwidth, any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows:

(1) On any frequency from the centre of the authorized bandwidth f0 to 5.625 kHz removed from f0: Zero dB.

(2) On any frequency removed from the centre of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 5.625 kHz but no more than 12.5 kHz: At least 7.27(f_d - 2.88 kHz) dB.

(3) On any frequency removed from the centre of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 12.5 kHz: At least 50 + 10 log (P) dB or 70 dB, whichever is the lesser attenuation.

4.2.2. TEST CONFIGURATION



4.2.3. TEST PROCEDURE

1 The EUT was placed on a turn table which is 0.8m above ground plane.
2 Set EUT as normal operation.
3 Set SPA Centre Frequency = fundamental frequency, RBW=300Hz, VBW= 3 KHz, span =50 KHz for channel bandwidth 12.5 KHz and 100 KHz for channel bandwidth 25 KHz.
4 Set SPA Max hold. Mark peak, Set 99% Occupied Bandwidth and 26dB Occupied Bandwidth.
5 Set SPA Centre Frequency=fundamental frequency, set =300Hz, VBW=1 KHz, span=50 KHz for 12.5 KHz channel spacing, set =300Hz, VBW=1 KHz, span=150 KHz for 25 KHz channel spacing.

4.2.4. TEST RESULTS

Occupied Bandwidth

Modulation Type	Channel Separation	Operation Mode	Test Channel	Test Frequency (MHz)	Occupied Bandwidth (KHz)	
					99%	26dB
GMSK	12.5 KHz	Op 1	Ch1	410.125	7.60	9.80
			Ch2	456.125	7.60	9.80
			Ch3	469.975	7.65	9.40
	25 KHz	Op 3	Ch4	410.250	15.40	19.60
			Ch5	456.250	15.90	19.10
			Ch6	469.850	15.50	19.00
Limit			11.25KHz for 12.5KHz Channel Separation			
			20KHz for 25KHz Channel Separation			
Test Results			PASS			

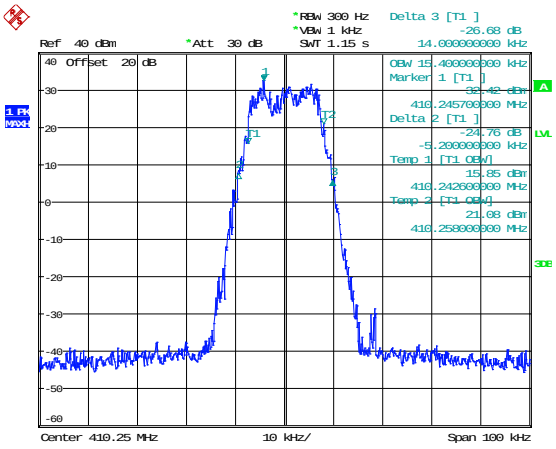
Remark:

1. Measured at Op 1 to Op 4, recorded worst case at Op 1 and Op 3.

2. Please refer to following plots;

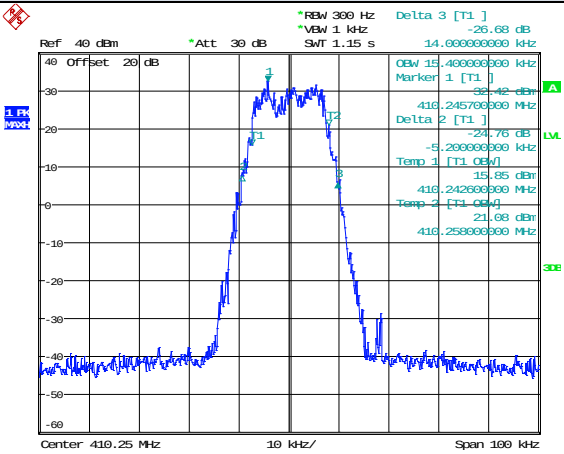
99% and 26dB Bandwidth

Op1



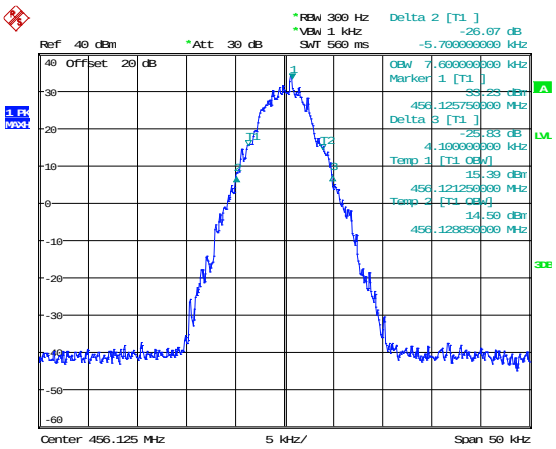
Date: 25.SEP.2017 17:52:42

Op3



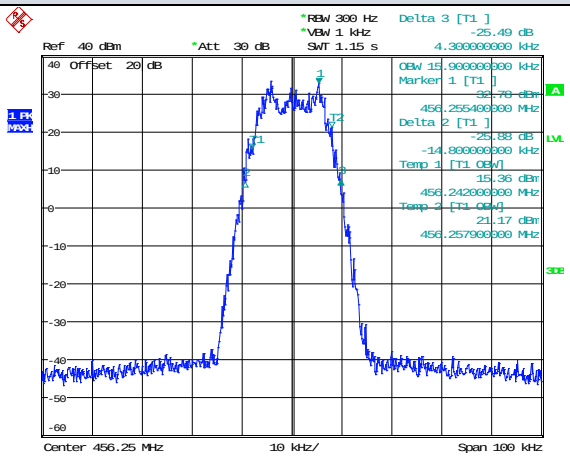
Date: 25.SEP.2017 17:52:42

Channel 1 / 410.125 MHz



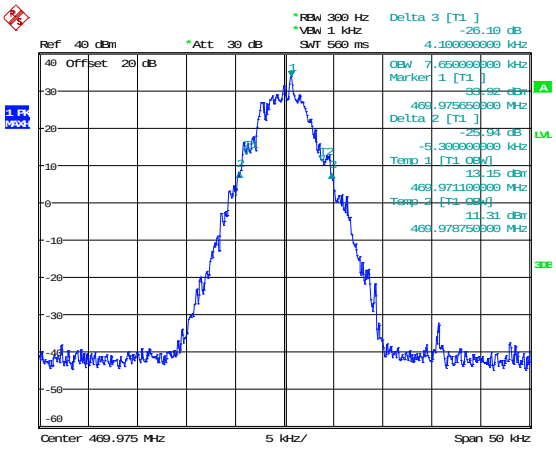
Date: 25.SEP.2017 17:49:06

Channel 4 / 410.250 MHz



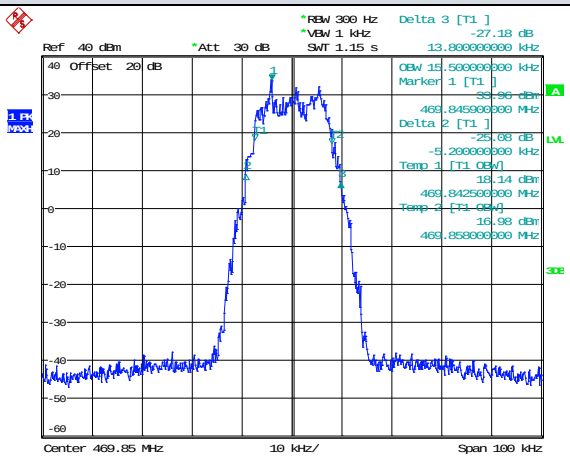
Date: 25.SEP.2017 17:54:30

Channel 2 / 456.125 MHz



Date: 25.SEP.2017 17:50:23

Channel 5 / 456.250 MHz



Date: 25.SEP.2017 17:57:04

Channel 3 / 469.975 MHz

Channel 6 / 469.850 MHz

Emission Mask

Modulation Type	Channel Separation	Operation Mode	Test Channel	Test Frequency (MHz)	Applicable Mask	RBW (Hz)
GMSK	12.5 KHz	Op 1	Ch1	410.125	D	300
			Ch2	456.125	D	300
			Ch3	469.975	D	300
	25 KHz	Op 3	Ch4	410.250	B	300
			Ch5	456.250	B	300
			Ch6	469.850	B	300
Test Results			PASS			

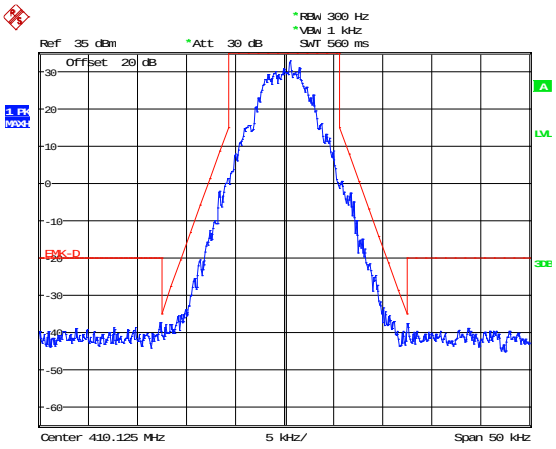
Remark:

1. Measured at Op 1 to Op 4, recorded worst case at Op 1 and Op 3.

2. Please refer to following plots;

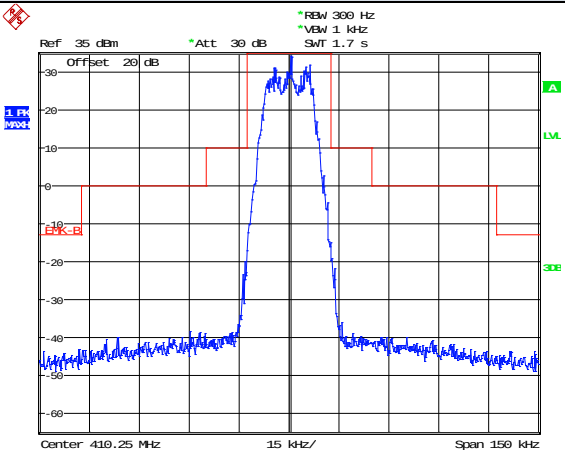
Emission Mask

OP1



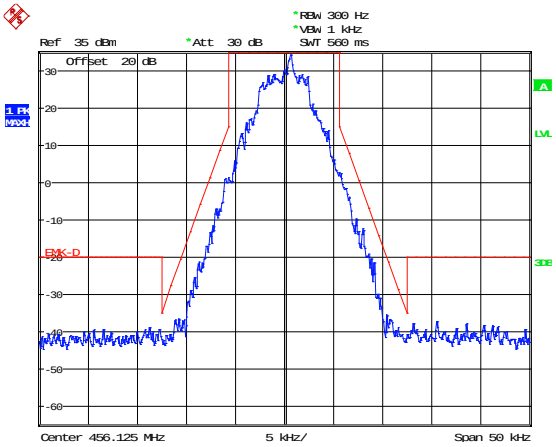
Date: 25.SEP.2017 18:01:28

OP3



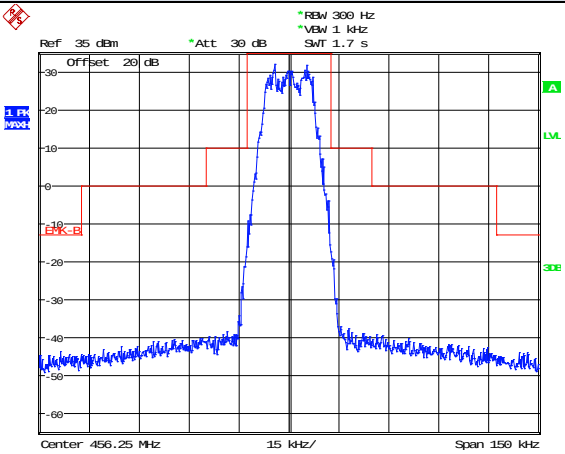
Date: 25.SEP.2017 18:09:02

Channel 1 / 410.125 MHz



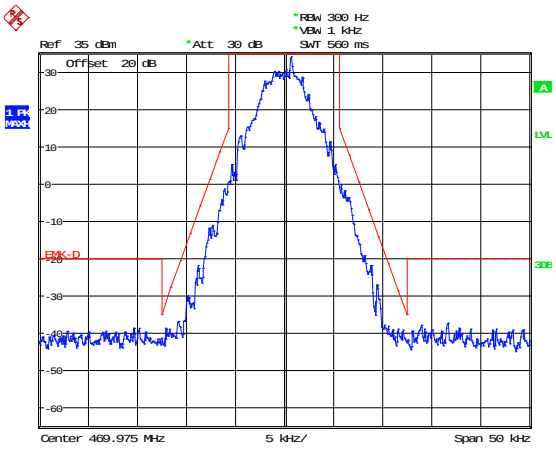
Date: 25.SEP.2017 18:02:25

Channel 4 / 410.250 MHz



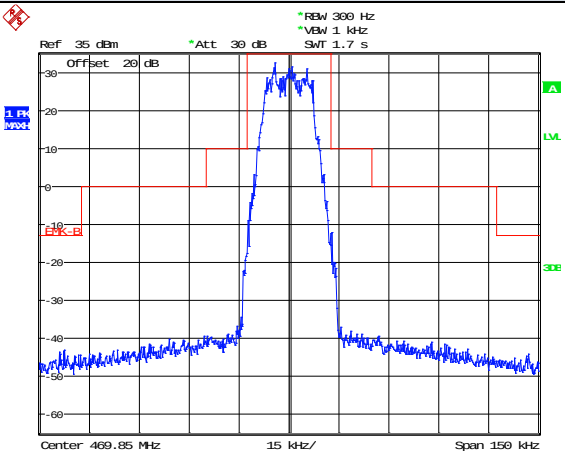
Date: 25.SEP.2017 18:12:04

Channel 2 / 456.125 MHz



Date: 25.SEP.2017 18:03:24

Channel 5 / 456.250 MHz



Date: 25.SEP.2017 18:19:44

Channel 3 / 469.975 MHz

Channel 6 / 469.850 MHz

4.3. Transmitter Radiated Spurious Emission

4.3.1. TEST APPLICABLE

According to the ANSI C63.26:2015 test method, and according to Section 90.210, the power of each unwanted emission shall be less than Transmitted Power as specified below for transmitters designed to operate with 12.5 KHz channel bandwidth:

1 On any frequency removed from the centre of the authorized bandwidth f_o to 5.625 KHz removed from f_o: Zero dB

2 On any frequency removed from the centre of the authorized bandwidth by a displacement frequency (f_d in KHz) f_o of more than 5.625 KHz but no more than 12.5 KHz: At least 7.27dB

3 On any frequency removed from the centre of the authorized bandwidth by a displacement frequency (f_d in KHz) f_o of more than 12.5 KHz: At least 50+10 log (P) dB or 70 dB, whichever is lesser attenuation.

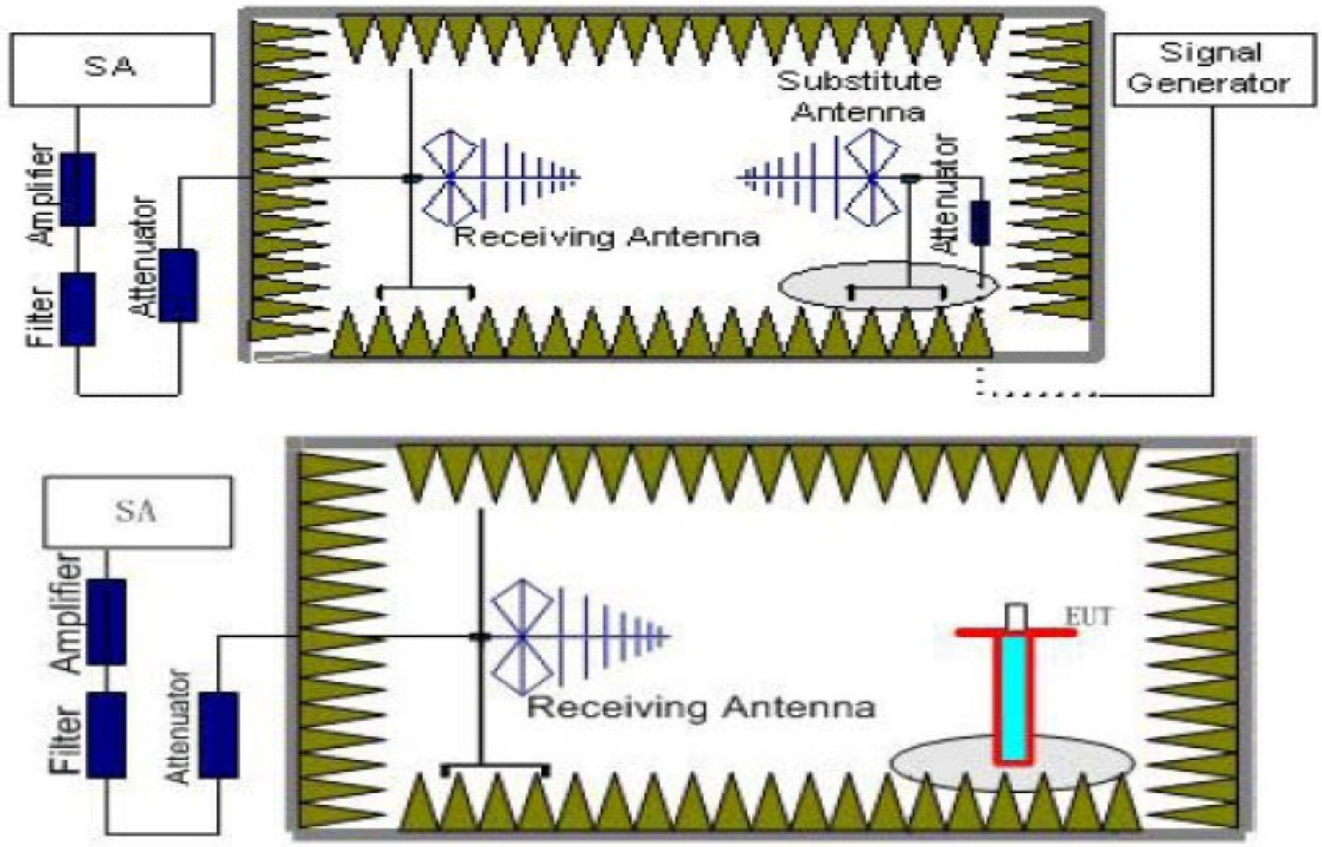
For transmitters designed to transmit with 25 KHz channel separation and equipped with an audio low-pass filter, the power of any emission must be attenuated below the unmodulated carrier power (P) as following:

1 On any frequency removed from the assigned frequency by more than 50 percent, but no more than 100 percent of the authorized bandwidth: At least 25 dB.

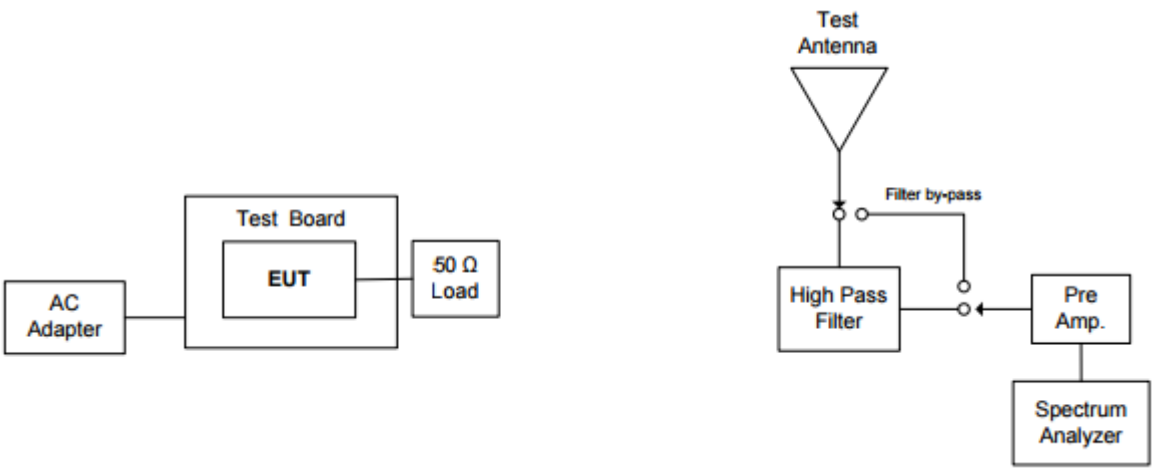
2 On any frequency removed from the assigned frequency by more than 100 percent, but no more than 250 percent of the authorized bandwidth: At least 35 dB.

3 On any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth: At least 43+10log (P) dB.

4.3.2. TEST CONFIGURATION



4.3.3. Test Arrangement



4.3.4. TEST PROCEDURE

1. EUT was placed on a 1.50 meter high non-conductive stand at a 3 meter test distance from the receive antenna. A receiving antenna was placed on the antenna mast 3 meters from the EUT for emission measurements. The height of receiving antenna is 1.50 m. Detected emissions were maximized at each frequency by rotating the EUT through 360° and adjusting the receiving antenna polarization. The radiated emission measurements of all transmit frequencies in six channels were measured with peak detector.
2. A log-periodic antenna or double-ridged waveguide horn antenna shall be substituted in place of the EUT. The log-periodic antenna will be driven by a signal generator and the level will be adjusted till the same power value on the spectrum analyzer or receiver. The level of the spurious emissions can be calculated through the level of the signal generator, cable loss, the gain of the substitution antenna and the reading of the spectrum analyzer or receiver.
3. The EUT is then put into continuously transmitting mode at its maximum power level during the test. Set Test Receiver or Spectrum RBW=1MHz, VBW=3MHz for above 1GHz and RBW=100 KHz, VBW=300 KHz for 30MHz to 1GHz, and the maximum value of the receiver should be recorded as (P_r).
4. The EUT shall be replaced by a substitution antenna. In the chamber, a substitution antenna for the frequency band of interest is placed at the reference point of the chamber. An RF Signal source for the frequency band of interest is connected to the substitution antenna with a cable that has been constructed to not interfere with the radiation pattern of the antenna. A power (P_{Mea}) is applied to the input of the substitution antenna, and adjusts the level of the signal generator output until the value of the receiver reach the previously recorded (P_r). The power of signal source (P_{Mea}) is recorded. The test should be performed by rotating the test item and adjusting the receiving antenna polarization.
5. An amplifier should be connected to the Signal Source output port. And the cable should be connecting between the Amplifier and the Substitution Antenna. The cable loss (P_{cl}), the Substitution Antenna Gain (G_a) and the Amplifier Gain (P_{Ag}) should be recorded after test.
   The measurement results are obtained as described below:
   Power (EIRP) = P_{Mea}- P_{Ag} - P_{cl} - G_a
   The measurement results are amending as described below:
   Power (EIRP) = P_{Mea}- P_{cl} - G_a

6. This value is EIRP since the measurement is calibrated using an antenna of known gain (2.15 dBi) and known input power.
7. ERP can be calculated from EIRP by subtracting the gain of the dipole, ERP = EIRP-2.15dBi.

4.3.5. LIMIT

Modulation Type: GMSK

FCC Part 22.359, 74.462, 80.211 and 90.210 and RSS Gen, RSS 119 Issue 12:

For 12.5 kHz bandwidth:
On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 12.5 kHz at least:
High: 50 + 10 log (Pwatts) = 50 + 10 log (3.0) =54.77 dB
Low: 50 + 10 log (Pwatts) = 50 + 10 log (1.0) =50.00 dB

Note: In general, the worst case attenuation requirement shown above was applied.
Calculation: Limit (dBm) =EL-50-10log10 (TP)
Notes: EL is the emission level of the Output Power expressed in dBm,
In this application, the EL is 34.77 dBm for High rated power and 30.00 for lower rated power.
High: Limit (dBm) = 34.77 – 50 – 10log (3.0) = -20 dBm
Low: Limit (dBm) = 30.00 – 50 – 10log (1.0) = -20 dBm

For 25 kHz bandwidth:
On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 62.5 kHz at least:
High: 43 + 10 log (Pwatts) = 43 + 10 log (3.0) = 47.77 dB
Low: 43 + 10 log (Pwatts) = 43 + 10 log (1.0) = 43.00 dB
Note: In general, the worst case attenuation requirement shown above was applied.
Calculation: Limit (dBm) =EL-43-10log10 (TP)
In this application, the EL is 34.77 dBm for High rated power and 30.00 for lower rated power.
High: Limit (dBm) = 34.77 – 43 – 10log (3.0) = -13 dBm
Low: Limit (dBm) = 30.00 – 43 – 10log (1.0) = -13 dBm

Note: 1. In general, the worst case attenuation requirement shown above was applied.
2. The measurement frequency range from 9 KHz to 5 GHz.
3. *** means that the emission level is too low to be measured or at least 20 dB down than the limit.
4. ERP for below 1GHz and EIRP above 1GHz.

4.3.6. TEST RESULTS

Remark:
1. Measured at Op 1 to Op 4, recorded worst case at Op 1 and Op 3.
2. Please refer to following page;

Modulation Type: GMSK							
Operation Mode: Op 1				Channel Separation:12.5KHz			
Test Channel: Channel 1				Test Frequency:410.125MHz			
Frequency (MHz)	P_{Mea} (dBm)	Path Loss	Antenna Gain	Correction (dB)	Peak EIRP (dBm)	Limit (dBm)	Polarization
820.250	-50.56	0.87	6.42	2.15	-47.16	-20.00	H
1230.375	-48.67	1.02	7.35	2.15	-44.49	-20.00	H
2050.625	-59.50	1.10	8.26	2.15	-54.49	-20.00	H
…	…	…	…	…	…	…	H
820.250	-53.47	0.87	6.42	2.15	-50.07	-20.00	V
1230.375	-47.21	1.02	7.35	2.15	-43.03	-20.00	V
2050.625	-59.44	1.10	8.26	2.15	-54.43	-20.00	V
…	…	…	…	…	…	…	V

Modulation Type: GMSK							
Operation Mode: Op 1				Channel Separation:12.5KHz			
Test Channel: Channel 2				Test Frequency: 456.125MHz			
Frequency (MHz)	P_{Mea} (dBm)	Path Loss	Antenna Gain	Correction (dB)	Peak EIRP (dBm)	Limit (dBm)	Polarization
912.250	-53.03	0.92	6.80	2.15	-49.30	-20.00	H
1368.375	-46.13	1.06	7.89	2.15	-41.45	-20.00	H
2280.625	-54.65	1.12	8.12	2.15	-49.80	-20.00	H
…	…	…	…	…	…	…	H
912.250	-50.80	0.92	6.80	2.15	-47.07	-20.00	V
1368.375	-46.51	1.06	7.89	2.15	-41.83	-20.00	V
2280.625	-57.49	1.12	8.12	2.15	-52.64	-20.00	V
…	…	…	…	…	…	…	V

Modulation Type: GMSK							
Operation Mode: Op 1				Channel Separation:12.5KHz			
Test Channel: Channel 3				Test Frequency: 469.975MHz			
Frequency (MHz)	P_{Mea} (dBm)	Path Loss	Antenna Gain	Correction (dB)	Peak EIRP (dBm)	Limit (dBm)	Polarization
939.950	-52.50	0.95	6.80	2.15	-48.80	-20.00	H
1409.925	-45.76	1.10	7.91	2.15	-41.10	-20.00	H
2349.875	-59.11	1.21	8.25	2.15	-54.22	-20.00	H
…	…	…	…	…	…	…	H
939.950	-52.52	0.95	6.80	2.15	-48.82	-20.00	V
1409.925	-44.17	1.10	7.91	2.15	-39.51	-20.00	V
2349.875	-58.41	1.21	8.25	2.15	-53.52	-20.00	V
…	…	…	…	…	…	…	V

Modulation Type: GMSK							
Operation Mode: Op 3				Channel Separation:25KHz			
Test Channel: Channel 4				Test Frequency:410.250MHz			
Frequency (MHz)	P_{Mea} (dBm)	Path Loss	Antenna Gain	Correction (dB)	Peak EIRP (dBm)	Limit (dBm)	Polarization
820.500	-49.84	0.87	6.42	2.15	-46.44	-13.00	H
1230.750	-45.18	1.02	7.35	2.15	-41.00	-13.00	H
2051.250	-54.51	1.10	8.26	2.15	-49.50	-13.00	H
…	…	…	…	…	…	…	H
820.500	-52.38	0.87	6.42	2.15	-48.98	-13.00	V
1230.750	-44.49	1.02	7.35	2.15	-40.31	-13.00	V
2051.250	-60.84	1.10	8.26	2.15	-55.83	-13.00	V
…	…	…	…	…	…	…	V

Modulation Type: GMSK							
Operation Mode: Op 3				Channel Separation:25KHz			
Test Channel: Channel 5				Test Frequency: 456.250MHz			
Frequency (MHz)	P_{Mea} (dBm)	Path Loss	Antenna Gain	Correction (dB)	Peak EIRP (dBm)	Limit (dBm)	Polarization
912.500	-50.76	0.92	6.80	2.15	-47.03	-13.00	H
1368.750	-45.38	1.06	7.89	2.15	-40.70	-13.00	H
2281.250	-57.81	1.12	8.12	2.15	-52.96	-13.00	H
…	…	…	…	…	…	…	H
912.500	-49.97	0.92	6.80	2.15	-46.24	-13.00	V
1368.750	-45.40	1.06	7.89	2.15	-40.72	-13.00	V
2281.250	-57.01	1.12	8.12	2.15	-52.16	-13.00	V
…	…	…	…	…	…	…	V

Modulation Type: GMSK							
Operation Mode: Op 3				Channel Separation:25KHz			
Test Channel: Channel 6				Test Frequency: 469.850MHz			
Frequency (MHz)	P_{Mea} (dBm)	Path Loss	Antenna Gain	Correction (dB)	Peak EIRP (dBm)	Limit (dBm)	Polarization
939.700	-50.49	0.95	6.80	2.15	-46.79	-13.00	H
1409.550	-44.22	1.10	7.91	2.15	-39.56	-13.00	H
2349.250	-60.65	1.21	8.25	2.15	-55.76	-13.00	H
…	…	…	…	…	…	…	H
939.700	-54.36	0.95	6.80	2.15	-50.66	-13.00	V
1409.550	-44.06	1.10	7.91	2.15	-39.40	-13.00	V
2349.250	-56.20	1.21	8.25	2.15	-51.31	-13.00	V
…	…	…	…	…	…	…	V

4.4. Spurious Emission on Antenna Port

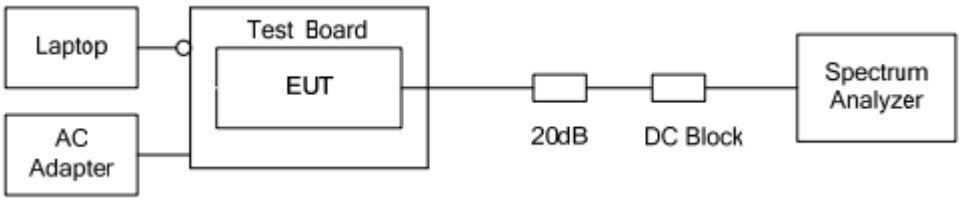
4.4.1. TEST APPLICABLE

The same as Section 4.3

4.4.2. TEST PROCEDURE

The RF output of the EUT was connected to a spectrum analyzer through appropriate attenuation. The resolution bandwidth of the spectrum analyzer was set to 100 kHz. Sufficient scans were taken to show any out of band emission up to 10th. Harmonic for the lower and the highest frequency range. Set RBW 1KHz, VBW 3KHz in the frequency band 9KHz to 150KHz, set RBW 10KHz, VBW 30 KHz in the frequency band 150KHz to 30 MHz, set RBW 100 kHz, VBW 300 kHz in the frequency band 30MHz to 1GHz,while set RBW=1MHz.VBW=3MHz from the 1GHz to 10th Harmonic.
The audio input was set to 0 to get the unmodulated carrier, the resulting picture is print out for each channel separation.

4.4.3. TEST CONFIGURATION



4.4.4. LIMIT

Modulation Type: GMSK

FCC Part 22.359, 74.462, 80.211 and 90.210 and RSS Gen, RSS 119 Issue 12:

For 12.5 kHz bandwidth:
On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 12.5 kHz at least:
High: 50 + 10 log (Pwatts) = 50 + 10 log (25) =63.98 dB
Low: 50 + 10 log (Pwatts) = 50 + 10 log (12) =60.79 dB

Note: In general, the worst case attenuation requirement shown above was applied.
Calculation: Limit (dBm) =EL-50-10log10 (TP)
Notes: EL is the emission level of the Output Power expressed in dBm,
In this application, the EL is 43.98 dBm for High rated power and 40.79 dBm for lower rated power.
High: Limit (dBm) = 43.98 – 50 – 10log (25) = -20 dBm
Low: Limit (dBm) = 40.79 – 50 – 10log (12) = -20 dBm

For 25 kHz bandwidth:
On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 62.5 kHz at least:
High: 43 + 10 log (Pwatts) = 43 + 10 log (25) = 56.98 dB
Low: 43 + 10 log (Pwatts) = 43 + 10 log (12) = 53.79 dB
Note: In general, the worst case attenuation requirement shown above was applied.

Calculation: Limit (dBm) =EL-43-10log10 (TP)

In this application, the EL is 43.98 dBm for High rated power and 40.79 dBm for lower rated power.

High: Limit (dBm) = 43.98 – 43 – 10log (25) = -13 dBm

Low: Limit (dBm) = 40.79 – 43 – 10log (12) = -13 dBm

Note: 1. In general, the worse case attenuation requirement shown above was applied.

2. The measurement frequency range from 9 KHz to 6GHz.

4.4.5. TEST RESULTS

Operation Mode	Test Channel	Test Frequency (MHz)	Measured Frequency Range	Spurious RF Conducted Emission (dBc)	Limits (dBc)	Verdict
Op 1	Ch1	410.125	9 KHz – 6 GHz	<-20	-20	PASS
	Ch2	456.125	9 KHz – 6 GHz	<-20		
	Ch3	469.975	9 KHz – 6 GHz	<-20		
Op 3	Ch4	410.250	9 KHz – 6 GHz	<-13	-13	PASS
	Ch5	456.250	9 KHz – 6 GHz	<-13		
	Ch6	469.850	9 KHz – 6 GHz	<-13		

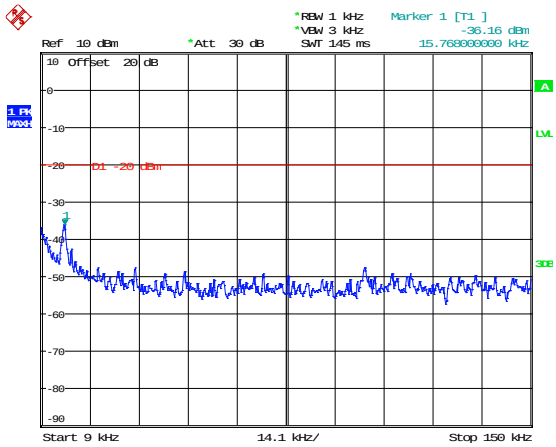
Remark:

1. Measured at Op 1 to Op 4, recorded worst case at Op 1 and Op 3.

2. Please refer to following plot;

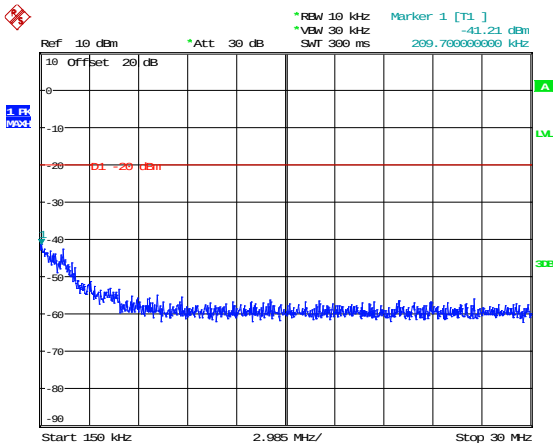
Spurious Emission on Antenna Port

Op 1 / Channel 1 / 410.125 MHz



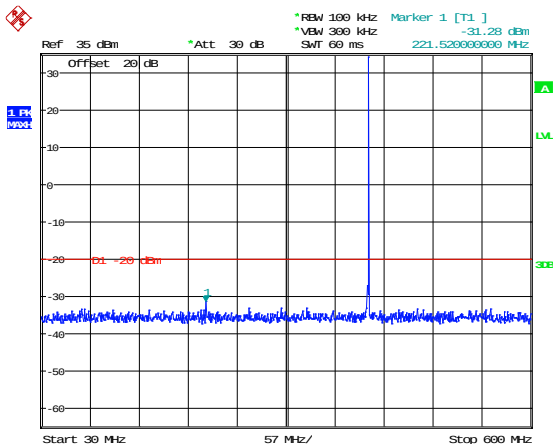
Date: 25.SEP.2017 18:24:36

9 KHz – 150 KHz



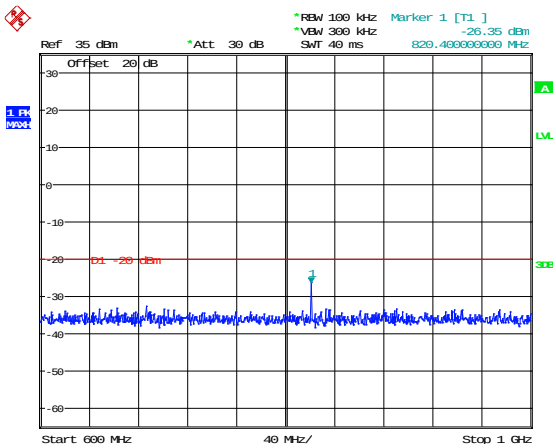
Date: 25.SEP.2017 18:25:01

150 KHz – 30 MHz



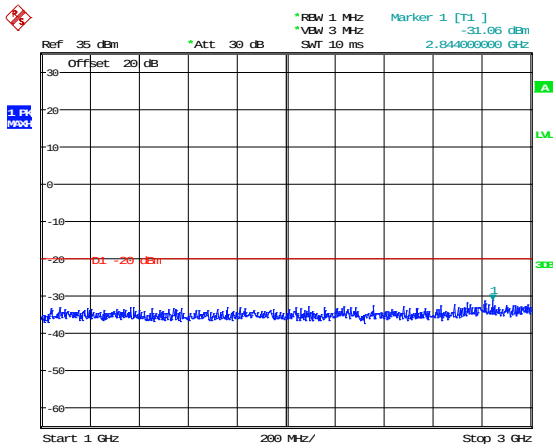
Date: 25.SEP.2017 18:26:26

30 MHz – 600 MHz



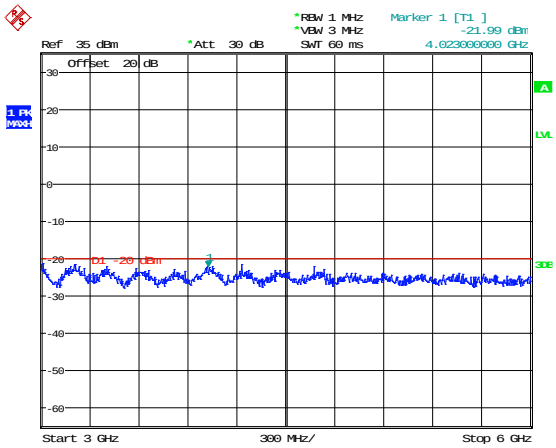
Date: 25.SEP.2017 18:28:04

600 MHz – 1000 MHz



Date: 25.SEP.2017 18:28:44

1 GHz – 3 GHz

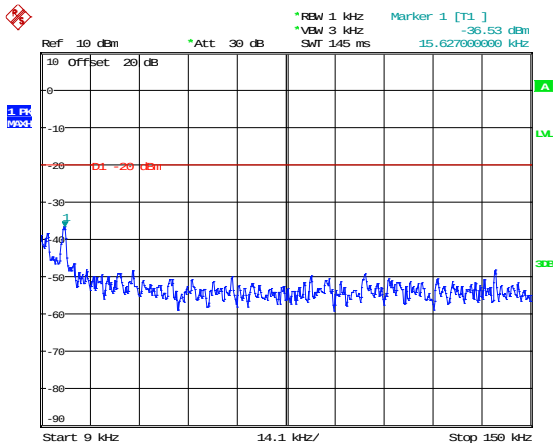


Date: 25.SEP.2017 18:30:25

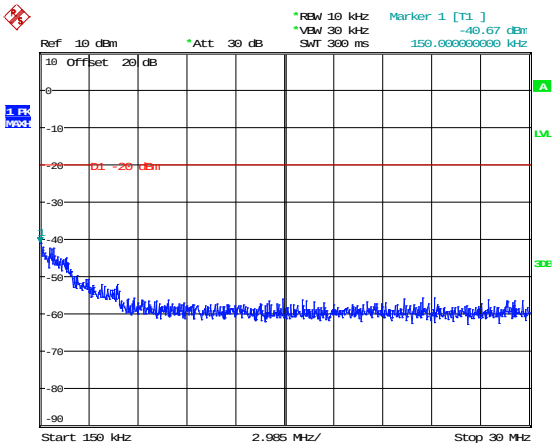
3 GHz – 5 GHz

Spurious Emission on Antenna Port

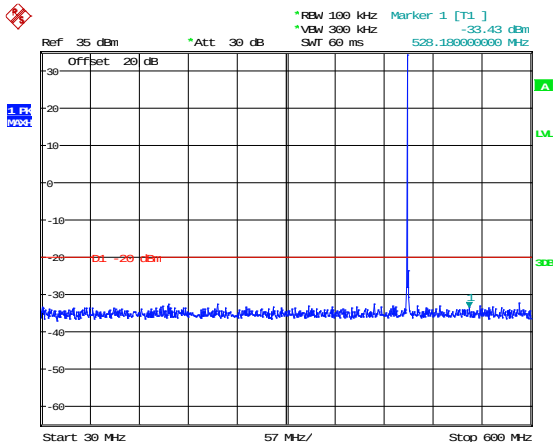
Op 1 / Channel 2 / 456.125 MHz



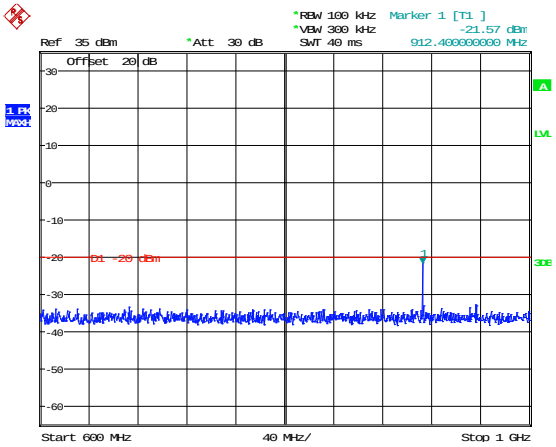
9 KHz – 150 KHz



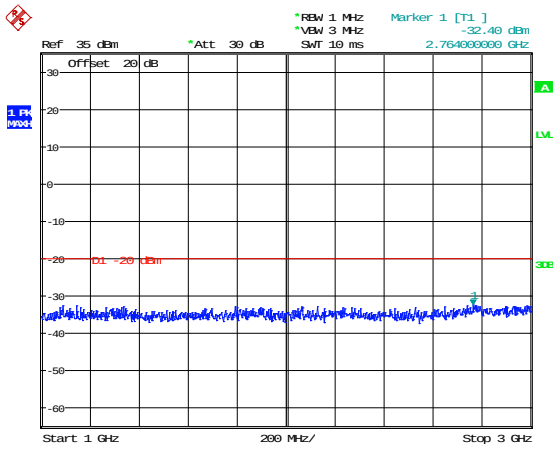
150 KHz – 30 MHz



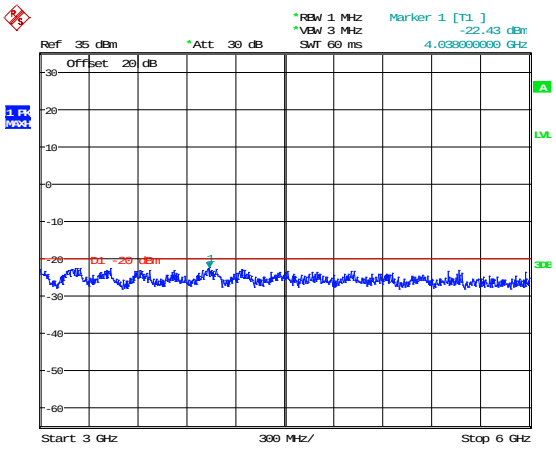
30 MHz – 600 MHz



600 MHz – 1000 MHz



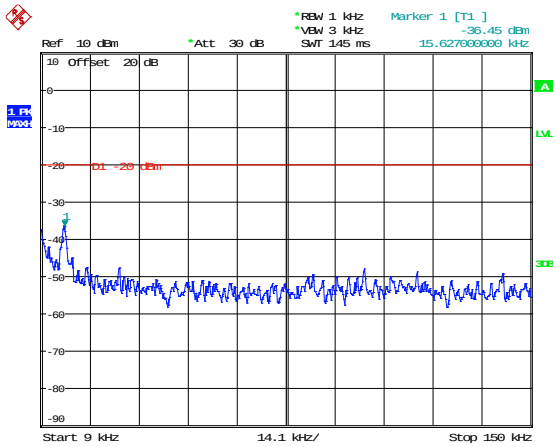
1 GHz – 3 GHz



3 GHz – 5 GHz

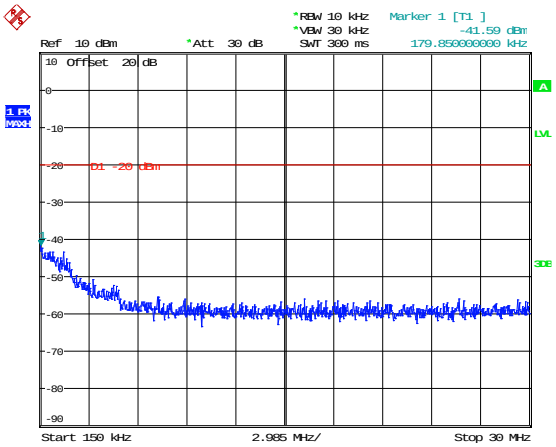
Spurious Emission on Antenna Port

Op 1 / Channel 3 / 469.975 MHz



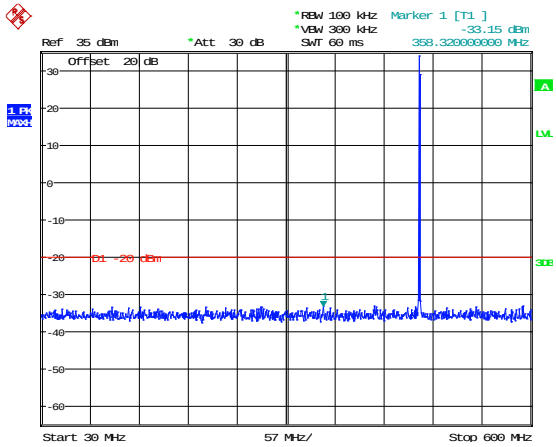
Date: 25.SEP.2017 18:23:52

9 KHz – 150 KHz



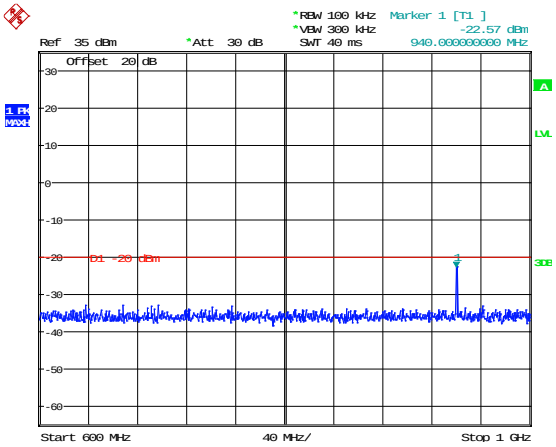
Date: 25.SEP.2017 18:25:49

150 KHz – 30 MHz



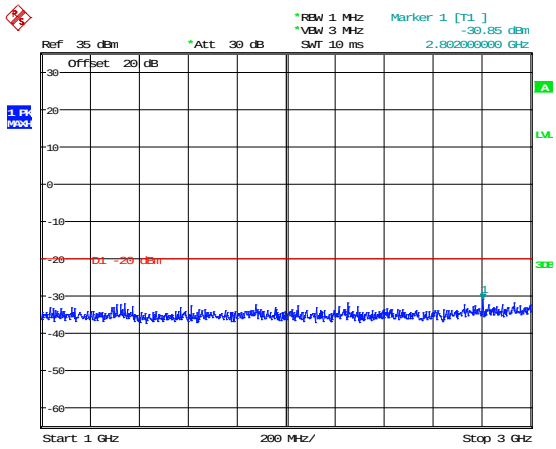
Date: 25.SEP.2017 18:27:13

30 MHz – 600 MHz



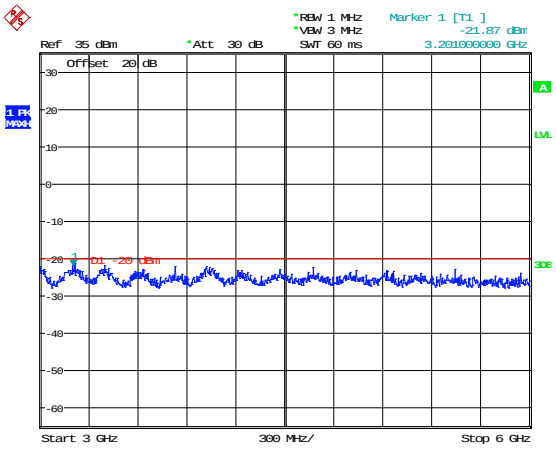
Date: 25.SEP.2017 18:27:38

600 MHz – 1000 MHz



Date: 25.SEP.2017 18:29:09

1 GHz – 3 GHz

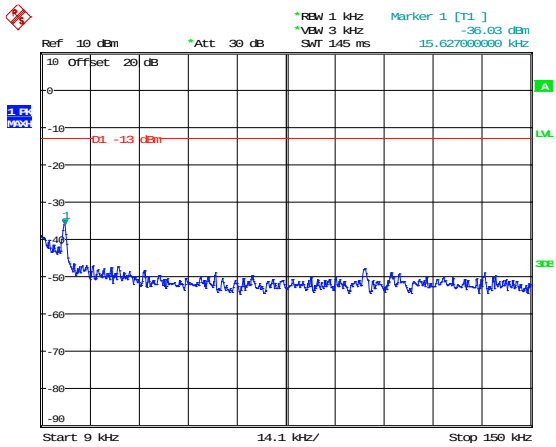


Date: 25.SEP.2017 18:29:47

3 GHz – 5 GHz

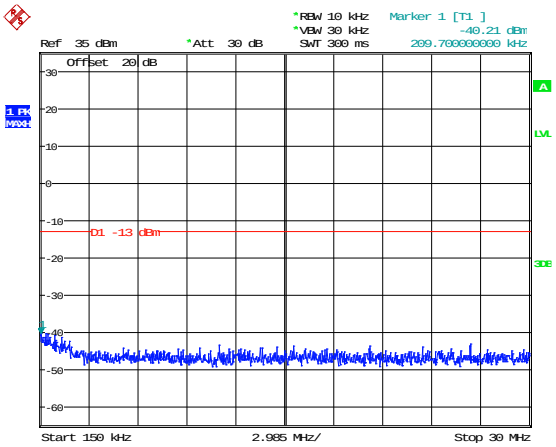
Spurious Emission on Antenna Port

Op 3 / Channel 4 / 410.250 MHz



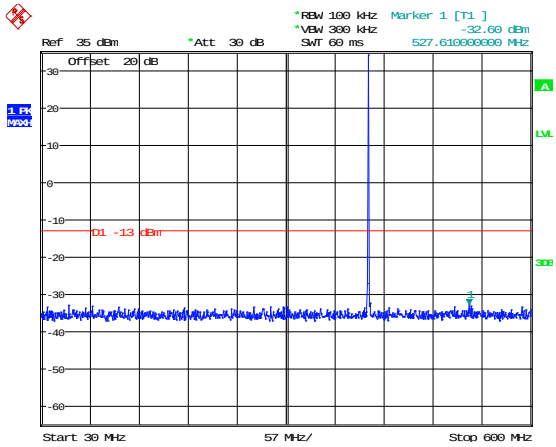
Date: 25.SEP.2017 18:22:42

9 KHz – 150 KHz



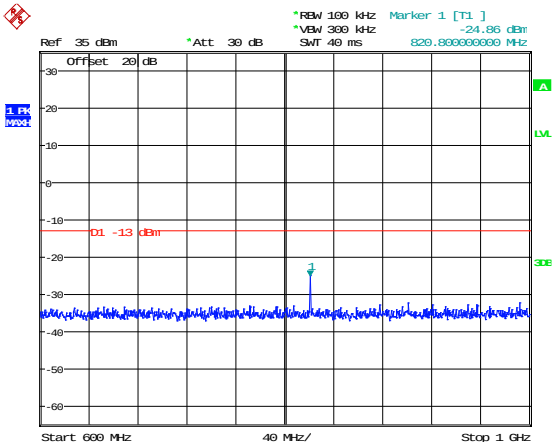
Date: 25.SEP.2017 18:32:23

150 KHz – 30 MHz



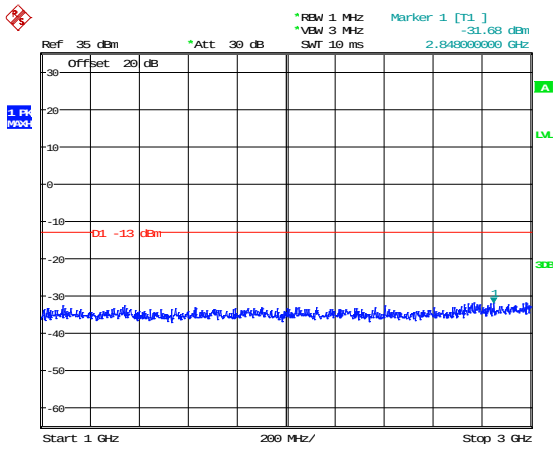
Date: 25.SEP.2017 18:34:39

30 MHz – 600 MHz



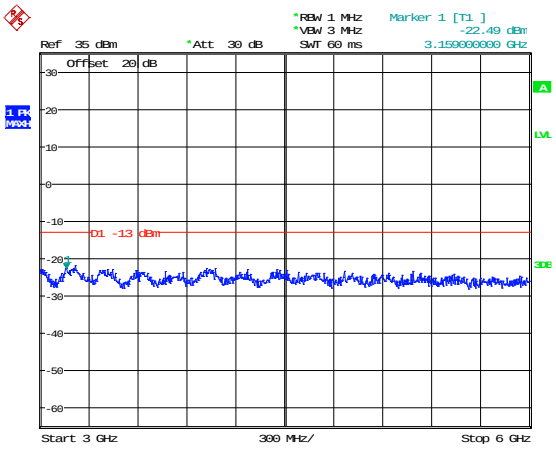
Date: 25.SEP.2017 18:42:07

600 MHz – 1000 MHz



Date: 25.SEP.2017 18:42:30

1 GHz – 3 GHz

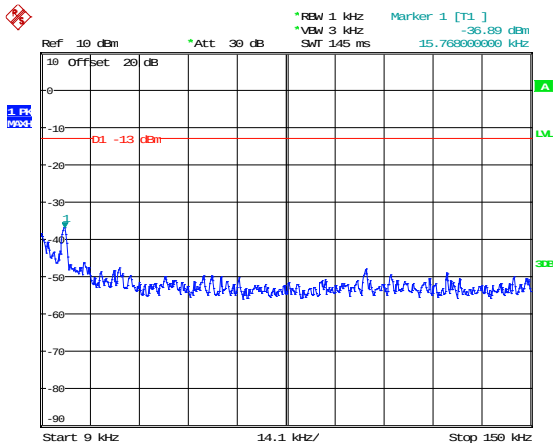


Date: 25.SEP.2017 18:31:40

3 GHz – 5 GHz

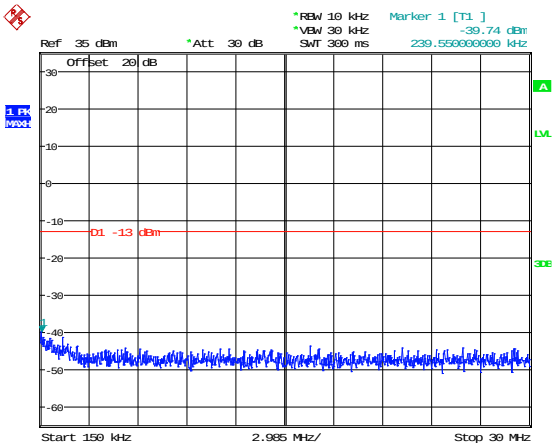
Spurious Emission on Antenna Port

Op 3 / Channel 5 / 456.250 MHz



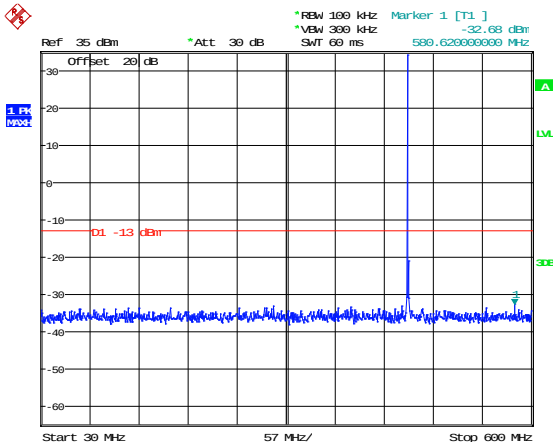
Date: 25.SEP.2017 18:23:07

9 KHz – 150 KHz



Date: 25.SEP.2017 18:32:34

150 KHz – 30 MHz



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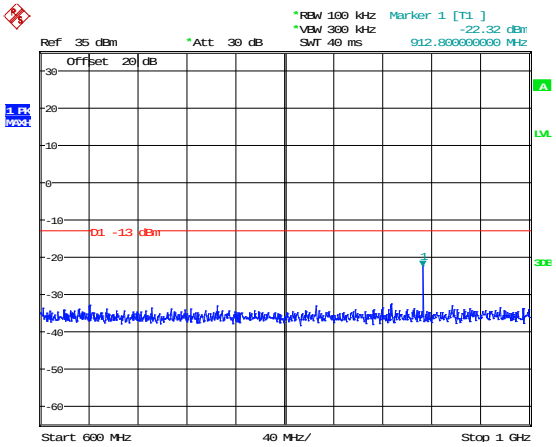
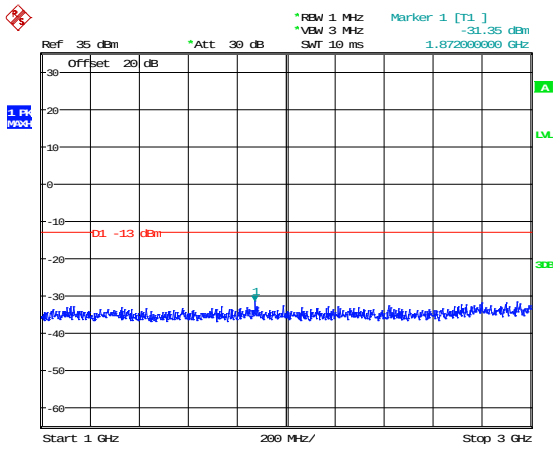
30 MHz – 600 MHz



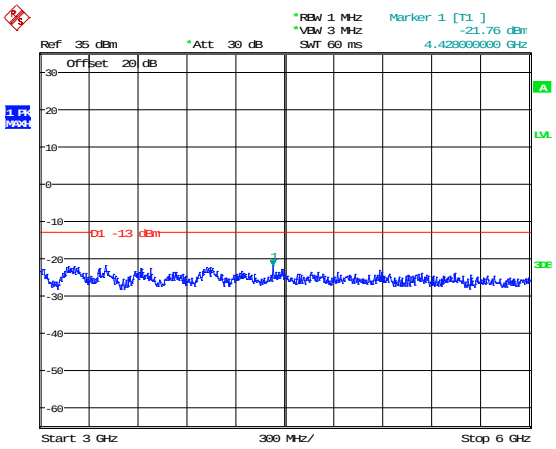
Date: 25.SEP.2017 18:36:17

600 MHz – 1000 MHz



Date: 25.SEP.2017 18:42:41

1 GHz – 3 GHz

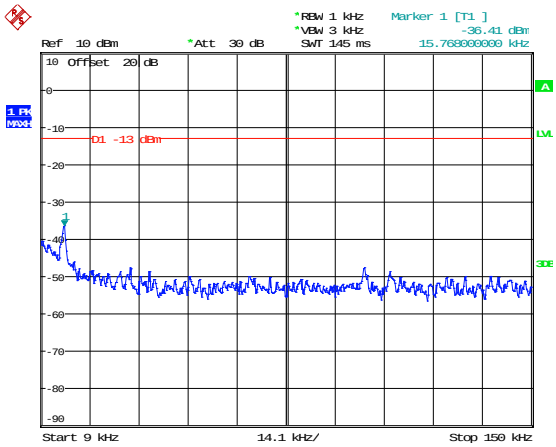


Date: 25.SEP.2017 18:31:30

3 GHz – 6 GHz

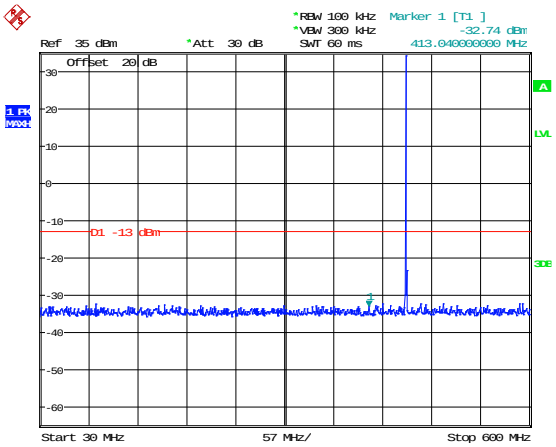
Spurious Emission on Antenna Port

Op 3 / Channel 6 / 469.850 MHz



Date: 25.SEP.2017 18:23:29

9 KHz – 150 KHz



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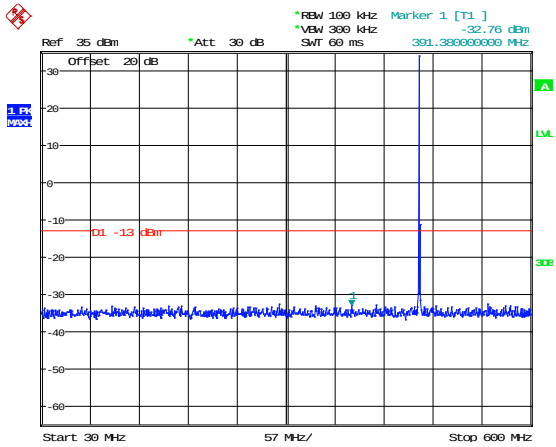
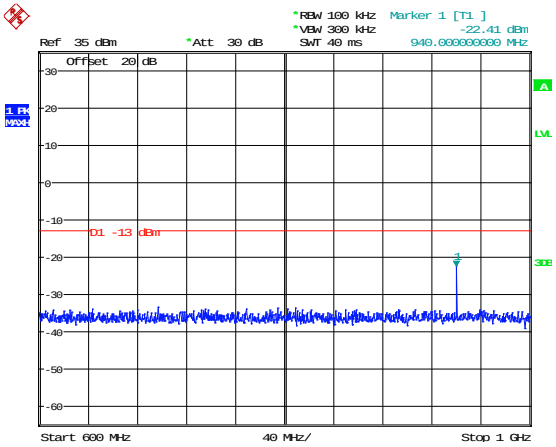
150 KHz – 30 MHz



Date: 25.SEP.2017 18:35:35

30 MHz – 600 MHz



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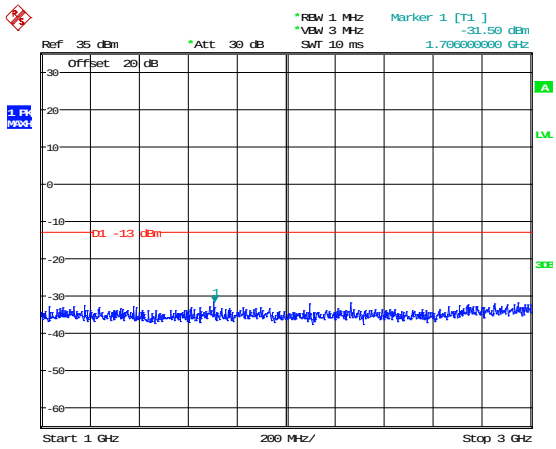
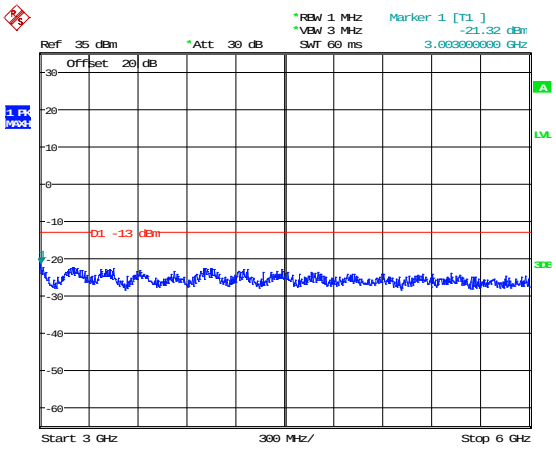
600 MHz – 1000 MHz



Date: 25.SEP.2017 18:42:51

1 GHz – 3 GHz



Date: 25.SEP.2017 18:30:49

3 GHz – 5 GHz

4.5. Modulation Characteristics - Modulation Limiting [§ 2.1047 (b)]

4.5.1. TEST APPLICABLE

§ 2.1047(b): Equipment which employs modulation limiting. A curve or family of curves showing the percentage of modulation versus the modulation input voltage shall be supplied. The information submitted shall be sufficient to show modulation limiting capability throughout the range of modulating frequencies and input modulating signal levels employed.

Recommended frequency deviation characteristics are given below:

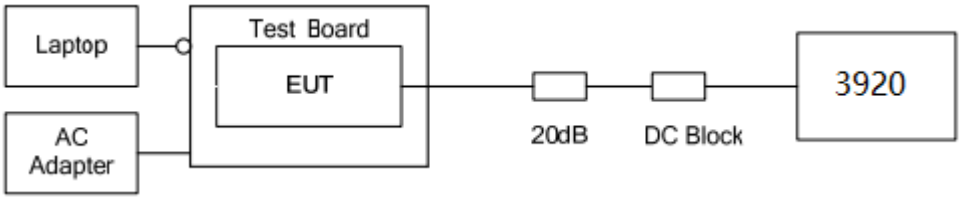
- 1.25 kHz for 6.25 kHz Channel Spacing System
- 2.5 KHz for 12.5 kHz Channel Spacing System
- 5 kHz for 25 kHz Channel Spacing System

4.5.2. TEST PROCEDURE

For Audio Transmitter: The carrier frequency deviation was measured with the tone input signal level varied from 0 Vp to audio input rating level plus 16 dB at frequencies 0.1, 0.5, 1.0, 3.0 and 5.0 kHz. The maximum deviation was recorded at each test condition.

For Data Transmitter with Maximum Frequency Deviation set by Factory: The EUT was set at maximum frequency deviation, and its peak frequency deviation was then measured using EUT's internal random data source.

4.5.3. TEST CONFIGURATION



4.5.4. TEST RESULTS

4.5.4.1. Data Modulation Limiting for 12.5 kHz Channel Spacing Operation

Operating Mode	Data Rate	Peak Frequency Deviation (KHz)
GMSK	9.6 kbps random data	1.58

4.5.4.2. Data Modulation Limiting for 25 kHz Channel Spacing Operation

Operating Mode	Data Rate	Peak Frequency Deviation (KHz)
GMSK	19.2 kbps random data	2.26

4.6. Frequency Stability Test

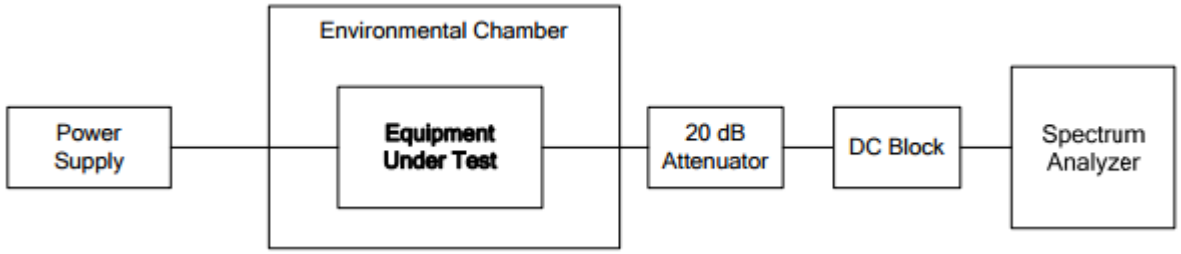
4.6.1. TEST APPLICABLE

1 According to FCC Part 2 Section 2.1055 (a) (1), the frequency stability shall be measured with variation of ambient temperature from -30℃ to +60℃ centigrade.
2 According to FCC Part 2 Section 2.1055 (e) (2), for battery powered equipment, the frequency stability shall be measured with reducing primary supply voltage to the battery operating end point, which is specified by the manufacture.
3 Vary primary supply voltage from 85 to 115 percent of the nominal value.
4 According to §90.213, the frequency stability limit is 2.5 ppm for 12.5KHz and 5.0ppm for 25KHz channel separation

4.6.2. TEST PROCEDURE

The EUT was set in the climate chamber and connected to an external DC power supply and AC power supply. The RF output was directly connected to Spectrum Analyzer ESCI3. The coupling loss of the additional cables was recorded and taken in account for all the measurements. After temperature stabilization (approx. 20 min for each stage), the frequency for the lower, the middle and the highest frequency range was recorded. For Frequency stability Vs. Voltage the EUT was connected to a DC power supply or AC power supply and the voltage was adjusted in the required ranges. The result was recorded.

4.6.3. TEST CONFIGURATION



4.6.4. TEST LIMITS

According to 90.213, Transmitters used must have minimum frequency stability as specified in the following table.

Frequency Range	Channel Bandwidth	Frequency Tolerance (ppm)		
		Fixed and Base Station	Mobile Stations	
			> 2W	≤ 2W
150-174MHz	6.25	1.0	2.0	2.0
	12.5	2.5	5.0	5.0
	25	5.0	5.0	50.0*
421-512MHz	6.25	0.5	1.0	1.0
	12.5	1.5	2.5	2.5
	25	2.5	5.0	5.0

* Stations operating in the 154.45 MHz or the 173.2 to 173.4 MHz bands must have a frequency stability of 5 ppm.
* Paging transmitters operating on paging-only frequencies must operate with frequency stability of 5 ppm in the 150-174 MHz band and 2.5 ppm in the 421-512 MHz band.

4.6.5. TEST RESULTS

Remark:

1. Measured at Op 7 to Op 10, recorded worst case at Op 7 and Op 9.

Operation Mode	Channel Separation	Test conditions		Frequency error (ppm)		
		Voltage(V)	Temp(℃)	410.125	456.125	469.975
Op1	12.5KHz	7.4 V	-30	0.52	0.30	0.21
			-20	0.38	0.85	0.98
			-10	0.86	0.72	0.10
			0	0.84	0.21	0.26
			10	0.26	0.35	0.53
			20	0.26	0.86	0.18
			30	0.34	0.61	0.62
			40	0.75	0.68	0.25
			50	0.13	0.60	0.39
		6.29 (85% Rated)	20	0.99	0.50	0.04
		8.51(115% Rated)	20	0.28	0.30	0.27
Limit			2.5 ppm			
Test Results			PASS			

Operation Mode	Channel Separation	Test conditions		Frequency error (ppm)		
		Voltage(V)	Temp(℃)	410.250	456.250	469.850
Op3	25KHz	7.4 V	-30	0.09	0.47	0.99
			-20	0.24	0.05	0.53
			-10	0.51	0.85	0.21
			0	0.66	0.19	0.35
			10	0.25	0.64	0.79
			20	0.37	0.79	0.22
			30	0.52	0.99	0.42
			40	0.83	0.61	0.09
			50	0.76	0.74	0.40
		6.29 (85% Rated)	20	0.32	0.30	0.39
		8.51(115% Rated)	20	0.95	0.44	0.80
Limit			5.0 ppm			
Test Results			PASS			

4.7. Maximum Transmitter Power

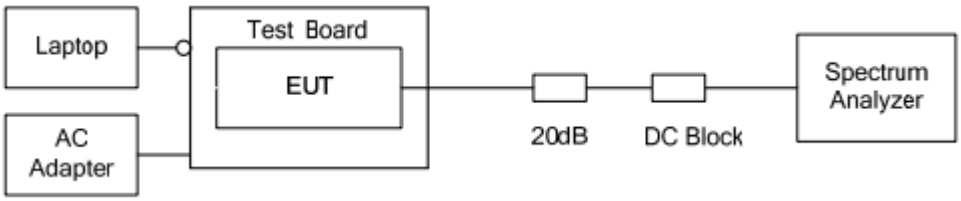
4.7.1. TEST APPLICABLE

Per FCC Part 2.1046 and Part 90.205: Maximum ERP is dependent upon the station's antenna HAAT and required service area.

4.7.2. TEST PROCEDURE

Measurements shall be made to establish the radio frequency power delivered by the transmitter the standard output termination. The power output shall be monitored and recorded and no adjustment shall be made to the transmitter after the test has begun, except as noted bellow:
If the power output is adjustable, measurements shall be made for the highest and lowest power levels.
The EUT connect to the Receiver through 20 dB attenuator.
Measurement with Spectrum Analyzer conducted external power supply with 7.4 V stabilized supply voltage.

4.7.3. TEST CONFIGURATION



4.7.4. TEST RESULTS

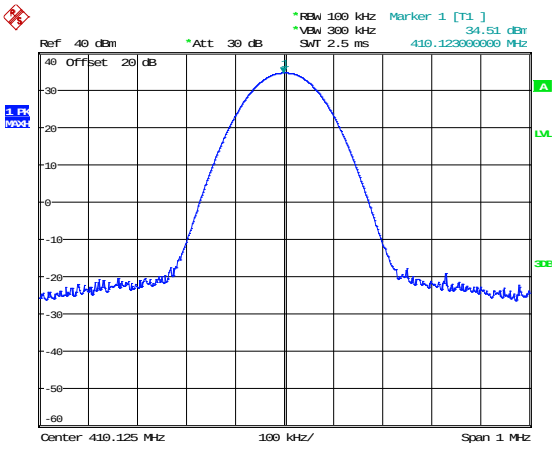
Modulation Type	Channel Separation	Operation Mode	Test Channel	Test Frequency (MHz)	Test Results (dBm)
Digital/GMSK	12.5KHz	Op 1	Ch1	410.125	34.51
			Ch2	456.125	34.57
			Ch3	469.975	34.38
		Op 2	Ch1	410.125	30.57
			Ch2	456.125	30.41
			Ch3	469.975	30.42
Digital/GMSK	25KHz	Op 3	Ch4	410.250	34.55
			Ch5	456.250	34.56
			Ch6	469.850	34.36
		Op 4	Ch4	410.250	30.58
			Ch5	456.250	30.47
			Ch6	469.850	30.46
Limit	The limit is dependent upon the station's antenna HAAT and required service area.				
Test Results	PASS				

Remark:

1. Please refer to following plot;

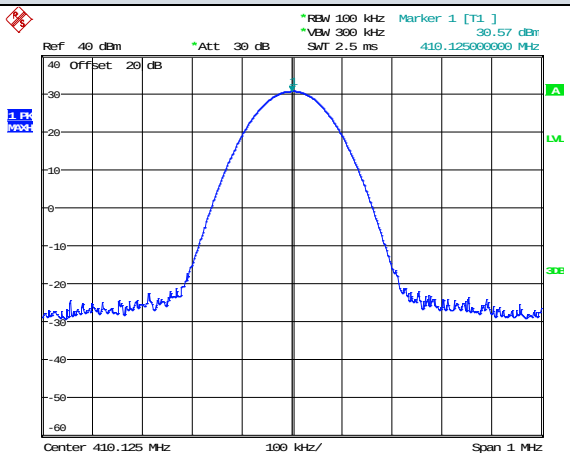
Transmitter Power

Op1



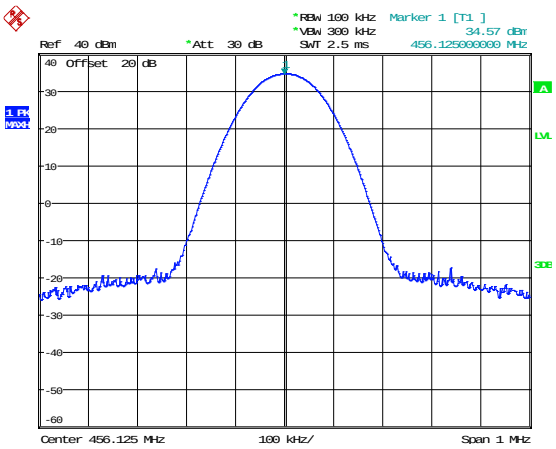
Date: 25.SEP.2017 16:50:23

Op2



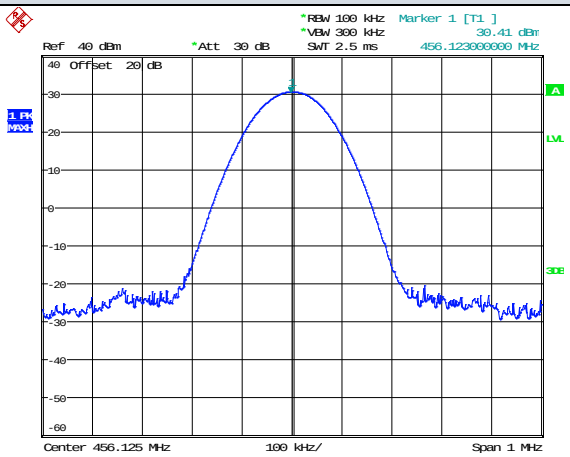
Date: 25.SEP.2017 17:40:54

Channel 1 / 410.125 MHz



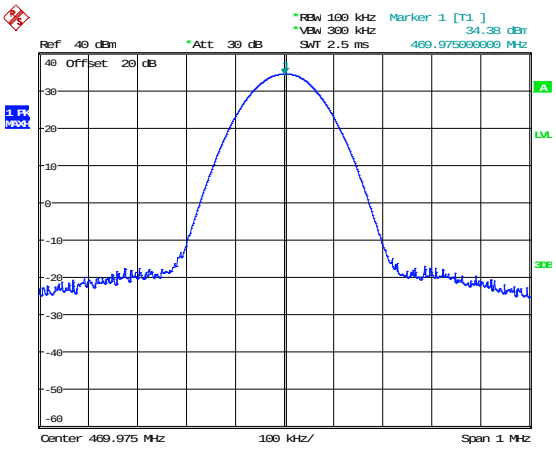
Date: 25.SEP.2017 16:51:12

Channel 1 / 410.125 MHz



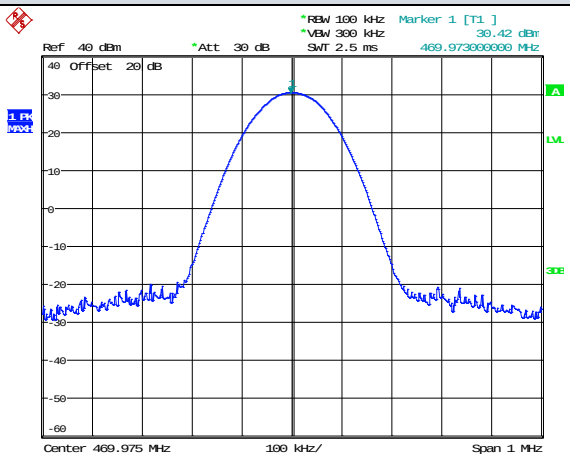
Date: 25.SEP.2017 17:41:53

Channel 2 / 456.125 MHz



Date: 25.SEP.2017 16:51:30

Channel 2 / 456.125 MHz



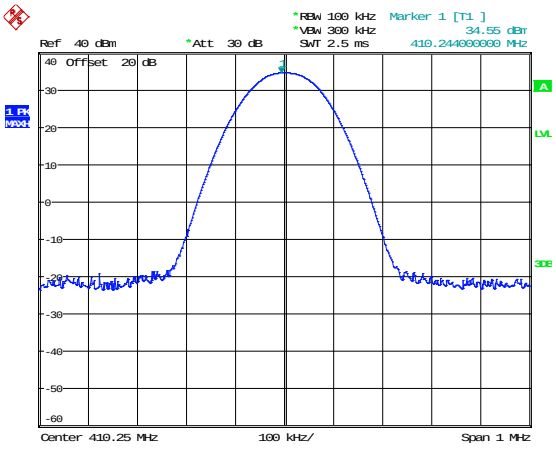
Date: 25.SEP.2017 17:42:08

Channel 3 / 469.975 MHz

Channel 3 / 469.975 MHz

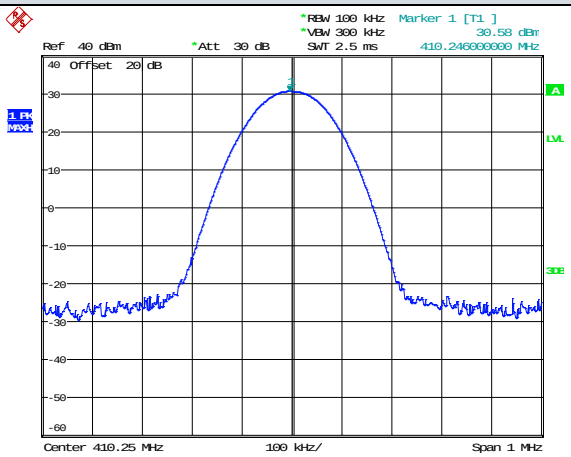
Transmitter Power

Op3



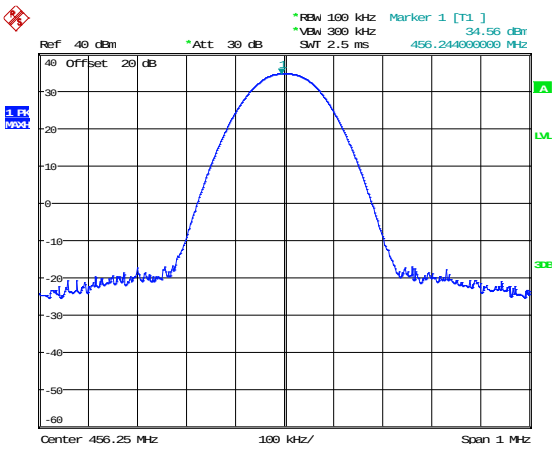
Date: 25.SEP.2017 16:52:06

Op4



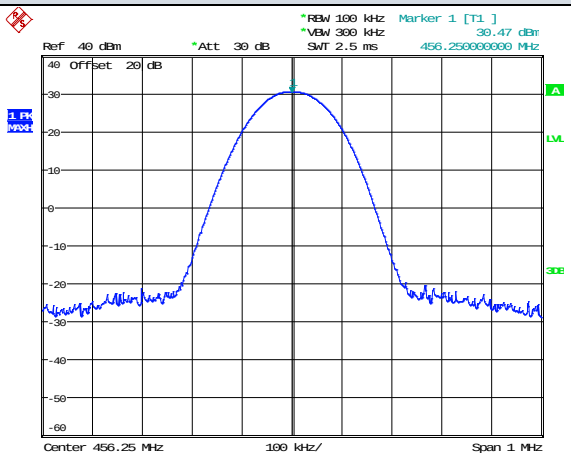
Date: 25.SEP.2017 17:42:28

Channel 4 / 410.250 MHz



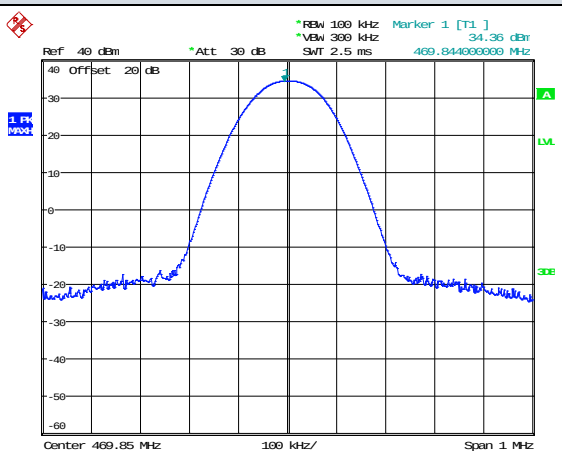
Date: 25.SEP.2017 16:52:26

Channel 4 / 410.250 MHz



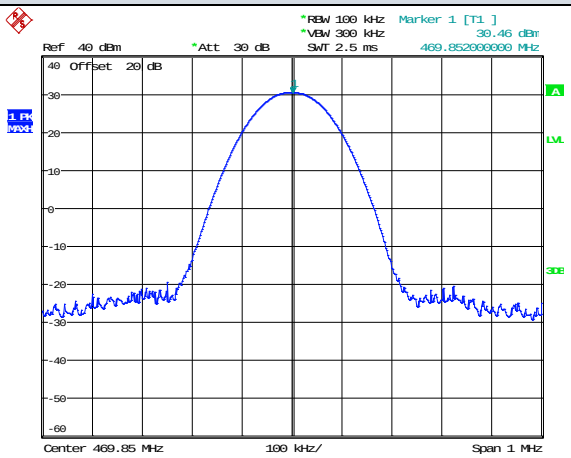
Date: 25.SEP.2017 17:42:53

Channel 5 / 456.250 MHz



Date: 25.SEP.2017 16:52:45

Channel 5 / 456.250 MHz



Date: 25.SEP.2017 17:43:09

Channel 6 / 469.850 MHz

Channel 6 / 469.850 MHz

4.8. Transmitter Frequency Behavior

4.8.1. TEST APPLICABLE

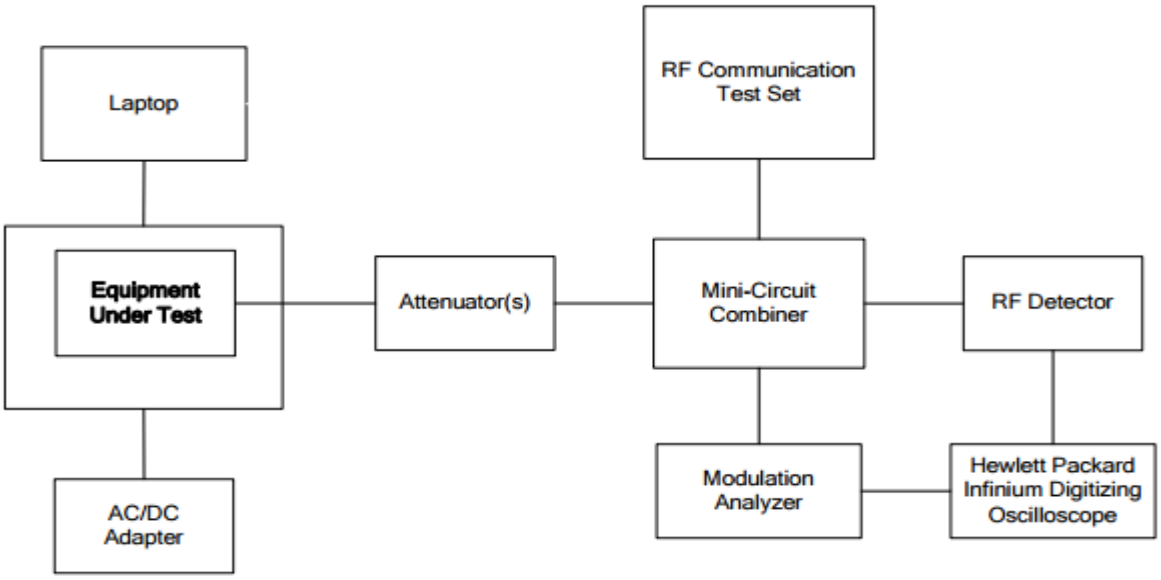
Section 90.214

Transient frequencies must be within the maximum frequency difference limits during the time intervals indicated:

Time intervals [1, 2]	Maximum frequency difference [3]	All equipment	
		150 to 174 MHz	421 to 512MHz
Transient Frequency Behavior for Equipment Designed to Operate on 25 KHz Channels			
t_1 [4]	± 25.0 KHz	5.0 ms	10.0 ms
t_2	± 12.5 KHz	20.0 ms	25.0 ms
t_3 [4]	± 25.0 KHz	5.0 ms	10.0 ms
Transient Frequency Behavior for Equipment Designed to Operate on 12.5 KHz Channels			
t_1 [4]	± 12.5 KHz	5.0 ms	10.0 ms
t_2	± 6.25 KHz	20.0 ms	25.0 ms
t_3 [4]	± 12.5 KHz	5.0 ms	10.0 ms
Transient Frequency Behavior for Equipment Designed to Operate on 6.25 KHz Channels			
t_1 [4]	±6.25 KHz	5.0 ms	10.0 ms
t_2	±3.125 KHz	20.0 ms	25.0 ms
t_3 [4]	±6.25 KHz	5.0 ms	10.0 ms

1. t_{on} is the instant when a 1 KHz test signal is completely suppressed, including any capture time due to phasing.
   t_1 is the time period immediately following t_{on}.
   t_2 is the time period immediately following t_1.
   t_3 is the time period from the instant when the transmitter is turned off until t_{off}.
   t_{off} is the instant when the 1 KHz test signal starts to rise.
2. During the time from the end of t_2 to the beginning of t_3, the frequency difference must not exceed the limits specified in § 90.213.
3. Difference between the actual transmitter frequency and the assigned transmitter frequency.
4. If the transmitter carrier output power rating is 6 watts or less, the frequency difference during this time period may exceed the maximum frequency difference for this time period.

4.8.2. TEST CONFIGURATION



4.8.3. TEST PROCEDURE

According to TIA/EIA-603 2.2.19 requirement.

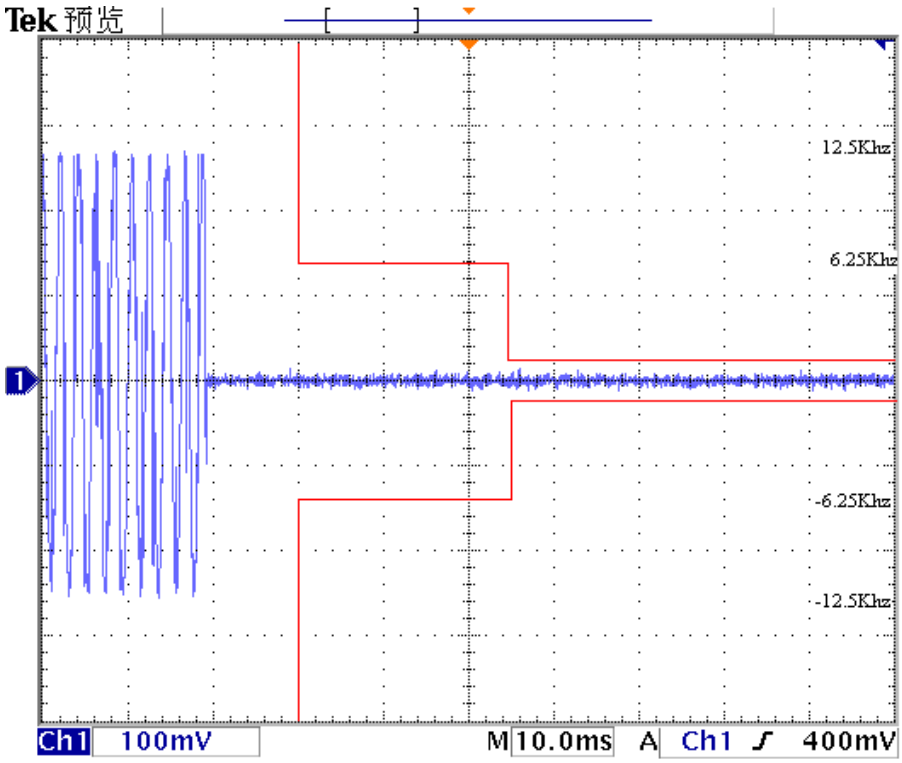
4.8.4. TEST RESULTS

Please refer to the following plots.

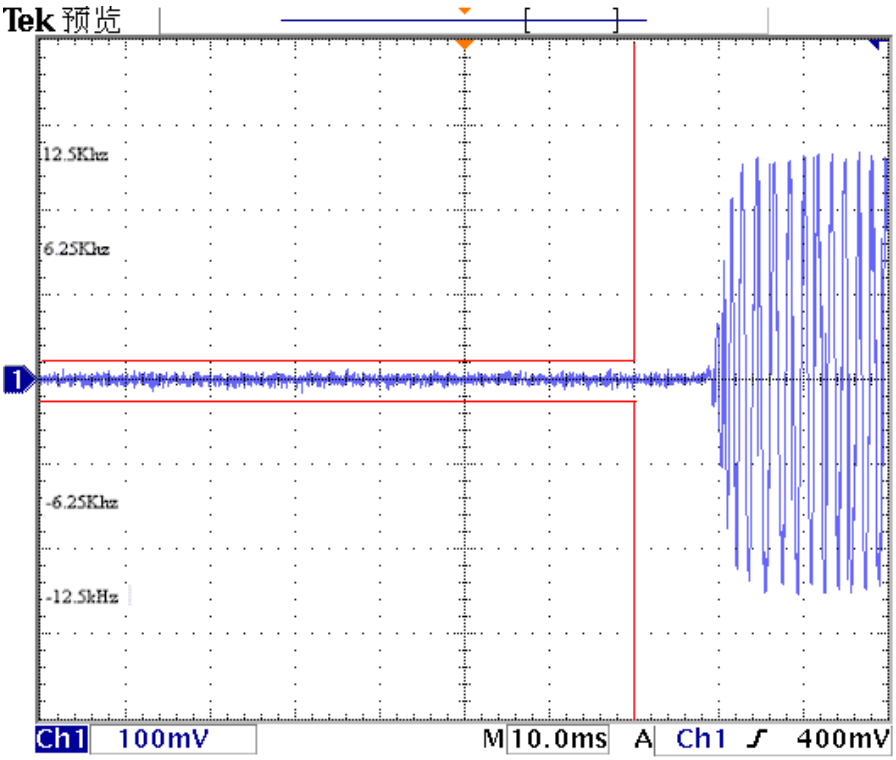
Measured at Op 1 to Op 4, recorded worst case at Op 1 and Op 3.

Modulation Type: GMSK

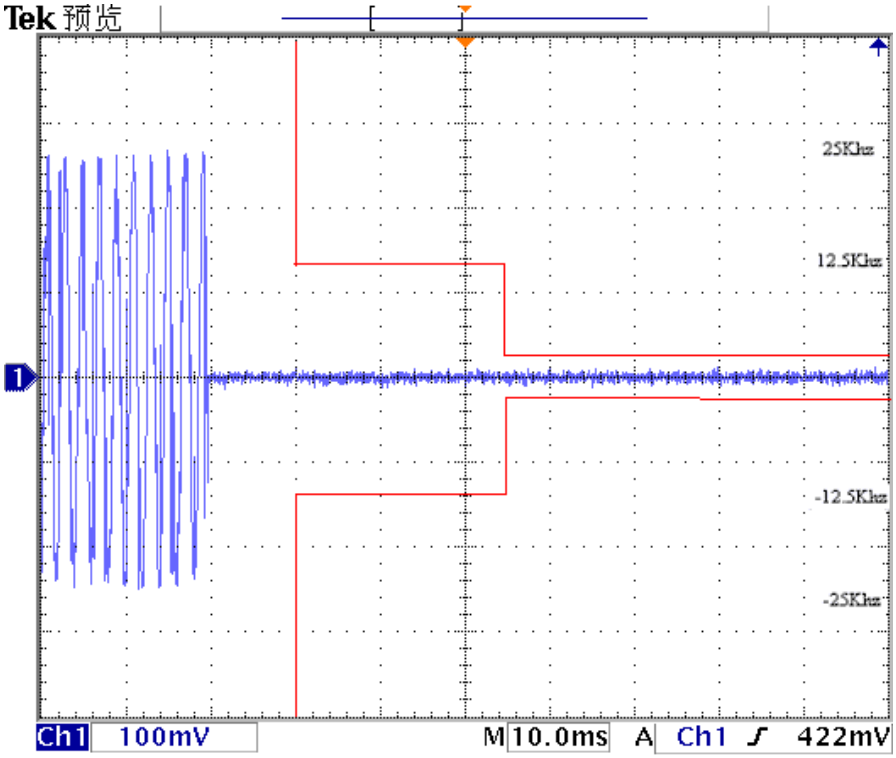
Transmitter Frequency Behavior @ 12.5 KHz Channel Separation------Off – On



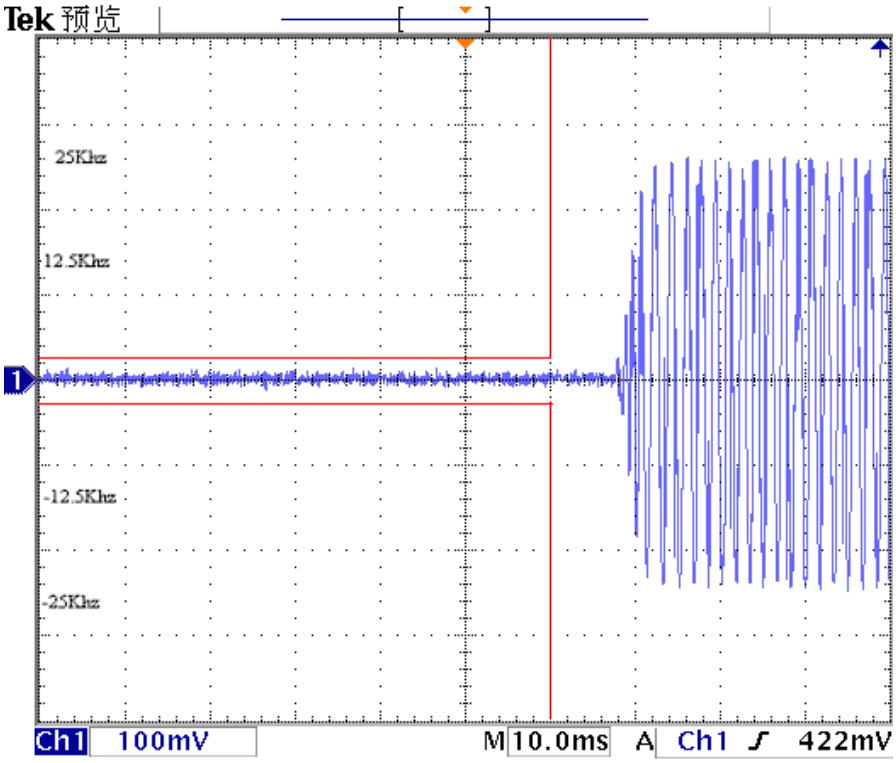
Transmitter Frequency Behavior @ 12.5 KHz Channel Separation------On – Off



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



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



5. LIST OF MEASURING EQUIPMENT

AC Power Conducted Emission				
Name of Equipment	Manufacturer	Model	Serial Number	Cal Date
Artificial Mains	MESS Tec	NNB-2/16Z	99079	June 17, 2017
EMI Test Receiver	R&S	ESCS 30	100174	June 17, 2017
EMI Test Software	Audix	E3	N/A	N/A
RF COMMUNICATION TEST SET	HP	8920A	3813A10245	June 18, 2017
Digital COMMUNICATION TEST SET	Aeroflex	3920	100245	June 18, 2017

Frequency Stability				
Name of Equipment	Manufacturer	Model	Serial Number	Cal Date
RF COMMUNICATION TEST SET	HP	8920A	3813A10245	June 18, 2017
Digital COMMUNICATION TEST SET	Aeroflex	3920	100245	June 18, 2017
Signal Generator	Rohde&Schwarz	SMR40	10016	July 15, 2017
Climate Chamber	Giant Force	GTH-225-20-S	MAB0103-00	June 17, 2017

Maximum Transmitter Power & Spurious Emission On Antenna Port & Occupied Bandwidth & Emission Mask				
Name of Equipment	Manufacturer	Model	Serial Number	Cal Date
Receiver	Rohde&Schwarz	ESPI 7	125590	June 18, 2017
RF COMMUNICATION TEST SET	HP	8920A	3813A10245	June 18, 2017
Digital COMMUNICATION TEST SET	Aeroflex	3920	100245	June 18, 2017
High-Pass Filter	Anritsu	MP526B	6220875288	July 15, 2017
High-Pass Filter	Anritsu	MP526D	6220878442	July 15, 2017

Transient Frequency Behavior				
Name of Equipment	Manufacturer	Model	Serial Number	Cal Date
Signal Generator	Rohde&Schwarz	SMR40	10016	July 15, 2017
Storage Oscilloscope	Tektronix	TDS3054B	B033154	July 16, 2017
RF COMMUNICATION TEST SET	HP	8920A	3813A10245	June 18, 2017
Digital COMMUNICATION TEST SET	Aeroflex	3920	100245	June 18, 2017

Transmitter Radiated Spurious Emission				
Name of Equipment	Manufacturer	Model	Serial Number	Cal Date
Receiver	Rohde&Schwarz	ESPI 7	125590	June 18, 2017
EMI Test Software	Audix	E3	N/A	N/A
RF COMMUNICATION TEST SET	HP	8920A	3813A10245	June 18, 2017
Digital COMMUNICATION TEST SET	Aeroflex	3920	100245	June 18, 2017
HORN ANTENNA	EMCO	3115	6741	June 09, 2017
HORN ANTENNA	EMCO	3115	6829	June 09, 2017
By-log Antenna	SCHWARZBECK	VULB9163	9163-470	June 09, 2017
By-log Antenna	SCHWARZBECK	VULB9163	9163-498	May 28, 2017
High-Pass Filter	Anritsu	MP526B	6220875288	July 15, 2017
High-Pass Filter	Anritsu	MP526D	6220878442	July 15, 2017

The calibration interval was one year.

6. PHOTOGRAPHS OF TEST SETUP

Please refer to separated files for Test Setup Photos of the EUT.

7. Exterior Photographs of the EUT

Please refer to separated files for External Photos of the EUT.

8. INTERIOR Photographs of the EUT

Please refer to separated files for Internal Photos of the EUT.

.....The End of Report.....